CLIMATE CHANGE PERCEPTION, ENGAGEMENT AND RESPONSE IN THE UNITED KINGDOM AND THE CROWN DEPENDENCIES: THE CASE OF YOUTH PARTICIPATION

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A thesis submitted in partial fulfilment

of the requirements of the

University of Northumbria at Newcastle

for the degree of

Doctor of Philosophy

Research undertaken in the

Department of Geography and Environmental Sciences

November 2020

Abstract

Despite anthropogenically induced climate change being viewed by many as one of the greatest societal challenges of the 21st century, discernment from the public, especially young people, remains under explored within the mitigation debate. This is surprising given research demonstrating the potential for collective action to reduce greenhouse gas emissions nationally through individual behaviour changes. Young people are those in society that will live with the effects of future climate change the longest but are typically overlooked in forward planning. Consequently, this PhD thesis aims to provide detailed understanding of intersecting perception of climate change and levels of engagement being undertaken to explore how people, particularly the young, are reacting to climate change.

The nexus of these themes was explored using a mixed method approach through the use of primary data collection, including interviews (*N* = 5), two national surveys (*N* = 1,134, survey 1 and *N* = 1,700, survey 2) and a participatory workshop using the Yonmenkaigi System Method approach (*N* = 16). In addition, this primary data is cross-analysed through the use of secondary data (BEIS and Eurobarometer) to extrapolate a more comprehensive picture based on the case of the United Kingdom.

The research found that in the United Kingdom (and implicitly elsewhere) there are high-levels of perception of climate change as a major concern, especially amongst young people, and more extensively since 2013 when a social tipping point around this issue occurred. This has occurred despite of the 'finite pool of worry', a theory suggesting a likely plateauing or decline in concern when other crises start to predominate in people's day to day, such as during the aftermath of the Brexit vote, COVID-19 and associated economic uncertainty.

In terms of youth and perception, this thesis found that whilst young people were the most likely to believe a climate change was happening and most likely to view that climate change is a serious problem, they were one of the least likely group of people to be able to determine what impacts were already being felt within the United Kingdom due to climate change.

Although there is this high level of belief in climate change amongst young people and civil society more widely, the level of engagement through mitigation strategies varies. Those strategies that are behavioural are generally undertaken, especially among the youngest in society and those who view climate change as serious. However, this applies when there is substantive investment. This demonstrates that if the government wants to implement significant change through the will of society to reduce greenhouse gas emissions, investment for those on low incomes is needed to enable

the requisite behaviour change needed. This research also confirms a view, as iterated by many of its respondents, that education on climate change within the United Kingdom is lacking; application of participatory methods, such as the Yonmenkaigi System Method, demonstrated how education would progress the interconnection between perception and engagement.

This study recognises complexity involved in the interconnection between perception, engagement and reaction. However, it is argued that if social media generates fake news especially around climate change, then young people who are the most personal users of social media should be the most exposed. The results show that they are the most believing of climate change and that it is likely social media self-reinforces consistent beliefs through echo chambers.

Into the current lacuna of action by the government during this PhD research period, climate activism groups of 'Extinction Rebellion' and 'School Strikes for Climate Change' materialised. It is argued that the actions of these groups are a form of 'post-normal engagement', where people apply their understanding, and that arises through a lack of facilitation of 'post-normal science' in relation to climate change within the United Kingdom. It was found that the majority of survey respondents were overall supportive of "Extinction Rebellion". In addition, it was found that there was also a majority of support for the children striking for climate change and the mass civil disobedience that "Extinction Rebellion" called for in London in April 2019, though at varying levels across the demographic. However, respondents were generally not willing to themselves join future "Extinction Rebellion" protests. Women, younger people and left-leaning voters were more likely to support these two types of protests. The monitoring of the demographic composition of climate protests in terms of perception and engagement drivers helps to assess the nature of likely reactions and resistance to future climate policy including that associated with the content of COP26 being hosted in the UK during 2021. However, the implementation of a post-normal climate change science might help reduce the need for climate activism.

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List of Abbreviations and Acronyms

^{o}C	Degree Celsius
^{o}F	Degree Fahrenheit
AA	Automotive Association
ACSAD	Arab Center for the Studies of Arid Zones and Dry Lands
AR5	IPCC Fifth Assessment Report
BAME	Black, Asian and Minority Ethnic
BBC	British Broadcasting Corporation
BEIS	Department for Business, Energy and Industrial Strategy
CBC News	Canadian Broadcasting Corporation News
CCC	Committee on Climate Change
CDP	Climate Disclosure Project
CFCs	Chlorofluorocarbons
CMEP	Commonwealth Marines Economies Programme
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide equivalent
COVID-19	Coronavirus disease 2019
DAERA	Department of Agriculture, Environment and Rural Affairs [Northern Ireland]
DECC	Department of Energy and Climate Change
DEFRA	Department of Environment, Food & Rural Affairs
DETR	Department for Environment, Transport and Regions
DfE	Department for Education
DfES	Department for Education and Skills
DoE	Department of the Environment
EA	Environment Agency
EEA	European Environment Agency
EPA	Environmental Protection Agency [United States]

EU	European Union
EU-15	European Union [1995 and 2003]
FoEI	Friends of the Earth International
HCFCs	Hydrochlorofluorocarbons
HFCs	Hydrofluorocarbons
IPCC	Intergovernmental Panel on Climate Change
ITF	International Transport Forum
ITV	Independent Television [United Kingdom]
$KtCO_2e$	Kilotonnes of carbon dioxide equivalent
LULUCF	Land use, land-use change, and forestry
$MtCO_2e$	Megatonnes of carbon dioxide equivalent
NASA	National Aeronautics and Space Administration
NIGOV	Northern Ireland Government
NOAA	National Oceanic and Atmospheric Administration
NSIDC	National Snow & Ice Data Center
NUTS	Nomenclature of Territorial Units for Statistics
NUTS1	First-Level Nomenclature of Territorial Units for Statistics
OECD	Organisation for Economic Co-Operation and Development
Ofcom	Office of Communications
Ofgem	Office of Gas and Electricity Markets
ONS	Office of National Statistics
PFCs	Perfluorocarbons
PHE	Public Health England
ppb	Parts per billon
PPCA	Powering Past Coal Alliance
ppm	Parts per million
ppt	Parts per trillion

SARS-CoV-2	Severe acute respiratory syndrome coronavirus 2
SREX	Special Report on managing the risks of extreme events and disasters to advance climate change adaptation
STEM	Science, Technology, Engineering and Mathematics
TGDFC	The Green Deal Finance Company
UCSUSA	Union of Concerned Scientists United States of America
UK	United Kingdom
UN	United Nations
UN DESA	United Nations Department of Economic and Social Affairs
UNESCO	United Nations Education, Scientific and Cultural Organisation
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNISDR	United Nations International Strategy for Disaster Reduction
USA	United States of America
USCA	United States Climate Alliance
WHO	World Health Organisation
WMO	World Meteorological Organisation
WWF	World Wide Fund for Nature
YSM	Yonmenkaigi System Method

Acknowledgements

These are the final words of this thesis to be written after four and half years of research and analysis. I would like to take this moment to expand my heartfelt thank you to some important people who have helped me to get to the finishing line of this PhD marathon.

Firstly, I would like to extend my immense gratitude to my principal supervisor, Professor Andrew Collins, who has over these past few years, has helped guide me through the world of academia, through thought-provoking discussions and provided evaluative commentary of both this thesis and other areas of my academic activities. In addition, I would like to thank the other members of my supervisory team, Dr Samantha Jones and Professor Alister Scott for providing critical and useful feedback comments on this thesis.

During the process of completing this thesis, I have made many friends amongst my fellow PhD colleagues, especially Adam Bermingham, Calian Hazell and Becky Richardson, who have provided me with support in various ways throughout the PhD process.

This process has to this stage of my academic career been difficult, but I probably would have not got here if it were not due to the inspiration from my initial tutor when I started at Northumbria University nine years ago, Professor Phil O'Keefe, who sadly passed away just a matter of days before I submitted this thesis. His passion for climate change, especially the political aspects, was truly inspiring in all conversations that we shared. I therefore would like to dedicate this PhD thesis to him.

I would also like to thank 'Northumbria University' and also 'Northumbria Students Union' that have provided addition funding to attend conferences and present my research in Bristol, Geneva and Kyoto.

My dear family and especially my grandparents have continuously provided inspiration before and during this PhD process. Without their loving encouragement and unwavering support for my life decision, especially in my efforts to undertake higher education; there are simply not enough that could be wrote here to begin thanking them for all they have done for me over the last twenty-seven years.

In addition, I would like to thank you, the reader of this thesis for taking the time in exploring and reading either parts or the whole thesis. I hope you have found it particularly interesting and informative.

Lastly, but most certainty not the least, I would like to thank Professor Jane Entwistle (Department of Geography and Environmental Science; Northumbria University) and Professor Richard Haigh

(Department of Biological and Geographical Sciences; University of Huddersfield) for examining this thesis. In addition, I would like to extend my thanks to Professor James McLaughlin (Department of Mathematics, Physics and Electrical Engineering; Northumbria University) for chairing my viva.

All there is left for me to say is diolch I bawb am eich holl gefnogaeth yn ystod yr ychydig flynyddoedd diwe diwethaf.

Declaration

I declare that the work contained in this thesis has been submitted for any other award and that it is all my own work. I also confirm that this work fully acknowledges opinions, ideas and contributions from the work of others.

Any ethical clearance for the research presented in this thesis has been approved. Approval has been sought and granted by the Faculty Ethics Committee on 10th February 2017.

I declare that the Word Count of this Thesis is 86,185 words

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Chapter One - Introduction

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"We are the first generation to be able to end poverty, and the last generation that can take steps to avoid the worst impacts of climate change. Future generations will judge us harshly if we fail to uphold our moral and historical responsibilities"

Ban Ki-Moon (2015, Online)
8th Secretary-General of the United Nations

This thesis explores "perception", "engagement", "reaction" and "response" in relation to the threat of climate change with a focus on youth. It is response to a need to further understand how young people both perceive and engage with climate change; as this group is the first generation to both feel and observe the full impacts though not the last to have to try to stop the most extreme climate change from occurring. The following section introduces five main themes and highlights key issues and gaps within the literature.

The issues are highlighted through a problem statement, which leads to the thesis aims and objectives. The chapter then outlines approaches the thesis has taken, presenting a rationale to the field research context and pathway to conclusions.

The chapter also establishes the positionality of the author of this thesis, explaining what he believes about climate change in the context of this work.

The chapter also explains the significance of the thesis towards the overall progression of knowledge within this area of research. The last section of the chapter provides a broad structure of the thesis and explains what each chapter explores.

1.1. Background to the Study

Climate change is defined as the large variation in the state of climate, which can occur over an extended period of a couple of decades or longer (Maunder, 1992; UNISDR, 2008; Grafton *et al.*, 2012). As highlighted by numerous researchers, climate change can occur in both anthropogenic and natural forms (Stott *et al.*, 2000; Tett *et al.*, 2002; Karl and Trenberth, 2003; Grafton *et al.*, 2012; Castree, Kitchin and Rogers, 2013). There is a consensus within the scientific community that current climate change is mainly caused by anthropogenic causes. The term "anthropogenic" is defined by Castee, Kitchen and Rogers (2013, p.18) as "something caused by intended or unintended human agency, as opposed to other causes such as natural forces". In the case of this thesis, the term anthropogenic climate change means human influenced climate change.

It is worth noting that the theory of humans altering the climate has its origins in ancient Greek times, when Theophrastus told of how the draining of marshes in specific locations made them more susceptible to freezing (Neumann, 1985). In addition, Theophrastus believed that the land becomes warmer when they become clear of forests. It was not until the Renaissance age [14^{th}-17^{th} Century], that it was observed methods of irrigation and deforestation were changing the climate, and it was concluded that human intervention can have an impact on the local climate (Neumann, 1985). This was the first time that a link between human activity and climate was made.

Increasing links were being made, by the scientific community and publicised in the media during the 1970s (Sawyer, 1972; Broecker, 1975; Manade and Wetherald, 1975; Stuiver, 1978) and 1980s (Manade and Wetherald, 1980; Hansen *et al.*, 1981; Dickinson and Cicerone, 1986; Matthews, 1988; Weisskopf, 1988; Bone, 1989; Mitchell, 1989; Pearce, 1989). Human altering of the climate started the debate about what would be the potential consequences; this was when the international community started to take notice. In 1988, the Intergovernmental Panel on Climate Change (IPCC) was established by the 'United Nations Environmental Programme' (UNEP) and 'World Meteorological Organisation' (WMO). The IPCC is recognised as the most prominent organisation on climate change science (Kerr and Kintisch, 2007; Bray, 2010). Its main aim is to examine all present scientific evidence about climate change, predicted climate change and policy responses; for example mitigation and adaptation. The United Nations organizations are collaborators into three sets of reports, which are released every few years. IPCC's main reports have been released in 1990, 1995, 2001, 2007 and 2013; with the next expected to be released in 2022. In addition, the IPCC also produce special reports to give additional information about climate change, which is usually not included in the main reports. These include reports on, but not limited to; 'Aviation and the Global Atmosphere' in 1999; 'Emission Scenarios' in 2000; 'Carbon Dioxide Capture and Storage' in 2005; 'Renewable Energy Sources and Climate Change Mitigation' in 2011; and 'Global Warming of 1.5°C' in 2018.

Within the latest full IPCC report, it was highlighted that the planet faces "severe, pervasive and irreversible" effects due to climate change if greenhouse gas emissions are not drastically cut (IPCC, 2014a, p. 56). Some of these effects are further examined in section 2.1. However, the IPCC reports are not the only official scientific collaborated reports about climate change. Other examples are Marines Economics (Cefas, 2018), and World Health Organisation (WHO, 2009). These scientific reports about the climate have even been located at more national scale, for example the 'UK Climate Change Risk Assessment 2017' within the United Kingdom and the 'National Climate Assessment 2014' in the United States.

The tone of the findings by the researchers within these reports is becoming more afflictive throughout the years, pointing to the increased understanding, concern and importance of the issue for the current and future generations. This is demonstrated by the cautious and questioning language used within the first IPCC report in 1992. For example, this highlights that:

> *"the size of this warming is broadly consistent with predictions of climate models, but it is also of the same magnitude as natural climate variability. Thus the observed increase could be largely due to this natural variability; alternatively this variability and other human factors could have offset a still larger human-induced greenhouse warming"*
>
> IPCC (1992, p. 5)

This demonstrates that at this point, as climate science was still relatively in its infancy, there were remaining questions over whether the temperature increases that had been observed from the 1950s until the 1980s were natural or due to anthropogenic activity. However, as highlighted in an earlier quote, there is little room left for that questioning, with the IPCC (2014a, p. 56) stating the planet faces "severe, pervasive and irreversible" damage if society does not reduce human induced greenhouse gas emissions. It demonstrates the increasing urgency that these reports are sounding to the international community.

This is further demonstrated by a consensus from the scientific community that the current climate change is caused by anthropogenic activity. Whilst, the exact value is still up for debate with figures of between 90 and 100 per cent (Oreskes, 2004; Schulte, 2008; Doran and Zimmerman, 2009, Anderegg *et al.*, 2010, Rosenberg *et al.*, 2010; Powell, 2015; Powell, 2019), commonly quoted figures reviewed by Cook et al. (2013) indicate that 97 per cent of published scientific literature supports the theory of anthropogenic climate change. Despite, studies that demonstrate that most of the scientific community believe that current climate change is caused by anthropogenic activity, there are some that criticise the high values. For example, Legates et al. (2015) suggest that Cook *et al.*'s (2013) statement of 97 per cent of academic literature supporting anthropogenic climate change is misleading due to the fact 66.39 per cent of academic papers that were surveyed did not state a firm position. The latest study in late 2019 by Powell highlights 100 per cent scientific consensus, as no research in the first half of 2019 was published that rejects anthropogenic climate change. Whilst, there is plenty of research being conducted that highlights the scientific consensus to be in the mid to late 90 per cent, it is questionable whether there can really ever be a 100 per cent consensus on any 'controversial' (to some sectors) scientific issue such as climate change?

However, smaller percentages of the population and scientific community either do not believe in the notion of anthropogenic climate change or are sceptical; these are known as climate deniers and climate sceptics respectively. Examples of these have to date included politicians such as Tony Abbot (Knott, 2020; Readfearn, 2020), Jair Bolsonaro (Tharoor, 2019), Neil Hamilton (Hayward, 2019), Nigel Lawson (Lawson, 2008; Carrington, 2017), Christopher Monckton (Monbiot, 2010; Monckton, 2015), Owen Paterson (Watt, 2012), Donald Trump (New York Times, 2016; Tharoor, 2019), Ann Widdecombe (Widdecombe, 2014); and researchers, such as, Robert Balling (Michaels, Balling and Balling, 2000), Craig Idso (Idso *et al.,* 2009), Ian Plimer (Plimer, 2009), Peter Ridd (Khan, 2019), Fred Singer (Singer and Avery, 2007; Idso *et al.*, 2009), Roy Spencer (Spencer, 2007; Spencer, 2008; Spencer, 2010), Valentina Zharkova (Nuccitelli, 2018).

1.1.1. Perception

Perception studies are important because climate change perception will influence whether an individual will engage with the issue. Amongst the public, studies about perception towards climate change have been undertaken for nearly thirty years (Brechin, 2010) and more regularly throughout the 2000s and 2010s, both by research groups and academia within the United Kingdom (Steentjes *et al.*, 2017; Poortinga *et al.*, 2019) and internationally (Steentjes *et al.*, 2017; Funtatsu *et al.*, 2019; Lorencová, Loučková and Vačkářů, 2019; Poortinga *et al.*, 2019). Appendix A provides examples of studies that have been undertaken within the United Kingdom and Appendix B for those studies internationally.

Perception is defined by Mayhew (2009) as a way in which an individual interprets the world around them through senses, which is shaped by their individual upbringing. Also, as climate change has emerged an interdisciplinary subject, its perception and interpretation can be defined in different ways. A way of defining perception with an environmental lens is "the way in which an individual perceives the environment; the process of evaluating and storing information received about the environment" (Mayhew, 2009 Online). Pidgeon *et al.* (1992, p.89) expanded this definition by combining psychological aspect of perception and combining it with risks, such as climate change; by stating that "risk perception involves people's beliefs, attitudes, judgements and feelings, as well as the wider social or cultural values and dispositions that people adopt towards hazards and their benefits". As highlight by Dessai *et al.* (2004, p.14) the public's perception of climate change is "based on psychological, social, moral, institutional and cultural processes". This is conceptually demonstrated later through Figure 1.1, within Section 1.8. The issue surrounding climate change perception is then further explored in Section 3.1 of this thesis.

It should be noted that the United States has been the most researched country in terms of climate change perception (Capstick *et al.*, 2015); however, there have been studies undertaken within the United Kingdom. As demonstrated within Appendix A, these have been undertaken by the academic community, research groups and governmental organisations about the British's public perception about subjects that relate to climate change, including, but limited to, issues surrounding energy, climate terminology and climate imagery. It was found within a recent survey that most of the British public tend to believe that anthropogenic factors are changing the world's climate (86 per cent) (Steentjes *et al.*, 2017). However, within the same study, it is demonstrated that the United Kingdom is six and seven per cent lower than France and Norway respectively. In addition, when comparing the findings of this study with previous studies, it was found that the proportion that believes that anthropogenic factors are changing the world's climate has declined from November 2005, when this percentage was 91 per cent using the same methodology, researchers and population (Poortinga, Pidgeon and Lorenzoni, 2006). However, it should be noted that this decline has not been linear and has recently shown signs of increasing again; with the lowest point occurring in March 2013 at 72 per cent (Poortinga *et al.*, 2013). This raises the question of whether an increasing proportion of the British public believe that anthropogenic factors are changing the climate. Details of this trend in the proportion of the British public that believe the world's climate is changing are provided in the findings and Appendix C of this thesis.

The percentage of the British public that believe climate change is the greatest threat, based on Eurobarometer data between April 2008 and March 2017, indicates an 18 per cent decline from 32 to 14 per cent during this ten-year period. However, this does not take into account that the term 'global warming' was used within the first sample. Therefore, using the first time that the Eurobarometer used the term 'climate change' in August-September 2009, it has only fallen by three per cent from 19 to 16 per cent, though fluctuating between 12 and 18 per cent during this time period. These results are important because past research has shown that many within civil society focus on one major societal issue at a time (Weber, 2006); this is likely to result in disengagement with climate change. Further data is provided in Appendix D.

Research has shown that levels of particular perceptions about climate change overtime fluctuate (Nisbet and Myers, 2007; Ballew *et al.*, 2019). This fluctuation could be as a result of media coverage (Mazur and Lee, 1993; Happer and Philo, 2016) or due to frequency and/or magnitude of extreme meteorological events in recent years (Brooks *et al.*, 2014; Shao *et al.*, 2014). Continuous studies of the public are required to monitor how the public responds to individual events.

Research has demonstrated that perception of climate change is not constant amongst the population, with differences amongst people with different worldviews. For example, there are differences between those who have a left-wing political ideology compared to those with a right-wing one (McCright, Dunlap and Marquart-Pyatt, 2016).

However, it was noticed that when researching climate change perception, one common gap in the research that emerged was the lack of published work involving or focusing on youth, as observed in the academic literature (Wray-Lake, Flanagan and Osgood, 2010; MacDonald *et al.,* 2013). Whilst since these studies, there have been some additional studies about youth and climate change, such as for example Walsh and Cordero (2019), the research is still lacking compared to other worldview positions, such as on gender and political identification. The implication of this is further discussed within the next section of this thesis.

In general, an increase in the perception that climate change is occurring and is a threat to society results in increased levels of engagement and behaviour to reduce emissions and promote environmental behaviour (Reser, Bradley and Ellul, 2014). However, in some extreme cases, researchers have observed eco-anxiety (Gifford and Gifford, 2016), which in some cases could cause disengagement due to a feeling of hopelessness about the future.

1.1.2. Engagement

Engagement can be defined as the action of a person in engaging with a specific reason or cause. In the terms of this thesis, it is the process of engaging with the issue of climate change. It has been observed that there are differences in levels of engagement in relation climate change across different societal groups (Corner, Markowitz and Pidgeon, 2014), based on gender, religion and political identification. These issues are further explored within Section 3.2. It has been highlighted by Collins *et al.* (2017) that further research is needed on engagement and disengagement within disaster related studies comprehensively, including climate change.

There are varying ways in which an individual can engage with climate change. Examples are activism, education, mitigation and adaptation strategies. As mitigation and adaptation strategies are large subjects in their own right, only mitigation strategies are only focused on for the purpose of engagement as addressed in this thesis. The main reasoning for the focus on mitigation strategies is that within the global North, mitigation strategies are achievable for young people, as the first line of defence, and whilst adaptation strategies tend to be more expensive and therefore are less achievable and desirable to confront the under 30’s with until mitigation has been addressed.

Specifically, mitigation strategies are focused on because these are activities that individuals, especially young people, can do at home and at work to reduce their carbon footprint. Examples of mitigation strategies are walking to work and eating less meat. The examination of mitigation strategies between different generations is lacking within the literature, as most research looks at the overall picture of what all people are undertaking without disaggregated analysis.

1.1.3. Reaction and Response

Reaction is defined by Matsumoto (2009, p.452) as "any behaviour which reliability occurs immediately after a stimulus or as a reaction stimulus". This depends in part on the ability of an individual during and after an extreme event. As seen globally, climate change amplifies extreme events. Therefore, reaction in this context includes how people think and respond during these events and in the aftermath how they reduce the event and/or its impacts.

There is a growing body of literature that suggests that in the aftermath of experiencing an extreme meteorological event, there is an increase in awareness and/or perception of climate change and the likelihood to engage with climate change (Reser, Bradley and Ellul, 2014; McDonald, Chai and Newell, 2015; Demski *et al.*, 2017; Bergquist, Nilsson and Schultz, 2019). But not all social scientists and psychologists believe this to be the case (Marshall, 2014), because additionally there can be a focus on the issue of rebuilding and trying to get a sense of normality by developing a fatalistic attitude towards climate change. These interpretations can be described as a degree of 'climate anxiety'.

Similarly, people also can 'respond' to climate change. The definition of response to climate change is loosely set out by Tompkins and Adger (2005, p. 564); "as any action taken by any region, nation, community or individual to tackle or manage environmental change, in anticipation of that change or after change has occurred". This definition is broad but distinctive as it differentiates between weather and climate, in that the definition does not use the terms of weather. Beyond this, the notion of activism as engagement furthers civil society members and politicians into action, such as seen in 2019 with 'Extinction Rebellion' and 'School Strike for Climate Change' within both the United Kingdom and internationally.

Both reaction and response to climate change will be further explored within the findings of this thesis.

Overall, this section has briefly introduced individuals' perception of, their engagement with, and their reaction and response towards climate change, suggesting these as important to reducing the effects and impacts that climate change will have on society. Further, it has flagged that there has been a lack of research undertaken on these processes in relation to youth.

1.2. Youth and Climate Change

Throughout history, different researchers have offered varying definitions of "youth" (Kahane and Rapoport, 1997). The terms "youth", "adolescent" and "young person" are often interchanged (Konopka, 1973). The term adolescence originates from the Latin term *adolescere*, which means "to grow up" (Kahane and Rapoport, 1997). Defining who is classed as "youth" can be quite complex, as scientists and organisations have different thresholds for this category. For example, variation within the United Nations in definitions of Youth and Adolescence are demonstrated in Table 1.1.

Table 1.1 – United Nations Definitions of "Youth" and "Adolescent"

United Nations Organisation	Age
UN Secretariats/UNESCO/ILO	Youth: 15-24
UN Habitat (Youth Fund)	Youth: 15-32
UNICEF/WHO/UNFPA	Adolescent: 10-19 Youth: 15-24 Young People: 10-24

Source: UN (No Date)

These variations demonstrate that even at an international level and within one institution, there is not a uniform definition of this age group. Within this thesis, a standard term is applied in that youth means anybody under the age of 25 years old. This is because it is the most common at the international level, and research is starting to show that an individual's development towards becoming an adult does not stop until the age of 25 (Sawyer et al., 2018), which is in line with the definition of *adolescere*.

Therefore, within this thesis, the 'youth' that will be explored are those between the ages of 15 and 24, which aligns with the definition laid out by most United Nations bodies, as defined within Table 1.1.

There are reasons why youth are a focus of this thesis in that whilst society might already be feeling the first effects of climate change [for example, the 2018 and 2019 heatwaves within the Northern Europe, North America and Japan; and 2019 forest fires in New South Wales and Queensland], the current generation of young people are going to be first to potentially feel the worst of the impacts of climate change (Lopez et al., 2018; ITV, 2018; Vaughan, 2018). It should also be noted that the young generation might be the last to stop the most dangerous climate change materialising (Pearce, 2010a). This is demonstrated in the quote from the former Secretary-General of the United Nations, Ban Ki-Moon at the beginning of this chapter.

Despite this, it has been highlighted within a couple of journal articles in recent years that there is a lack of research that investigates youth perception and engagement towards environmental issues, especially climate change (Wray-Lake, Flanagan and Osgood, 2010; MacDonald et al., 2013).

This is surprising, when considering that, depending on the period represented by the definition in Table 1.1, the youth make up between 33.7 and 41.4 per cent of the world's population; or 23.3 and 29.4 per cent of the United Kingdom's population (UN DESA, 2019). This demonstrates that not investigating young people's perception and engagement with climate change is a major issue since they make up a large proportion of the population at both global and national scale that are arguably facing different circumstances to the generations that preceded them. It suggests a fundamental gap within the literature currently.

This is further surprising, given the international community have recognised that the engagement of young people has been important in relation to climate change for the last twenty-six years. During the 1992 Earth Summit resolution that was adopted, also known as Agenda 21, it is highlighted in chapter 25 that both children and youth are important in sustainable development issues; and that they should be recognised as one of the nine key stakeholders (UN, 1992). Further evidence that the international policy community calls for engaging young people with climate change is highlighted in the Section 36(a)(i) of the UNISDR Sendai Framework for Action (2015-2030) which highlights that:

> *"Children and youth are agents of change and should be given the space and modalities to contribute to disaster risk reduction, in accordance with legislation, national practice and educational curricula"*
>
> UNISDR (2015, p.23)

In relation to being recognised by the international community and world leaders, another important reason why young people need to be further researched in terms of perception and engagement with climate issues, is that there is a policy pathway set within the United Kingdom until 2050 to mitigate against climate change through developing a decarbonised society[1]; which will include the current young generation (Corner et al., 2015), This will mean that the current young generation are one of the first generations that will observe and participate in the transformation.

A further rationale for a focus on young people is that during the adolescence period, they start undergoing cognitive changes and because of this start to question the world around them and to

[1] - Section 2.2 provides further information on what the United Kingdom is undertaking to develop this decarbonised society through policy.

develop their own personal beliefs (Lerner, Lerner and Finkelstein, 2001). In addition, within this stage of development, the teenagers and young adults are more likely to take more risks in relation to any other age group (Steinberg, 2008). This is in part due to invincibility theory (Wickman, Anderson and Greenberg, 2008). If young people have that sense of invincibility theory, especially "it-won't-happen-to-me", this might lead to young people thinking that the effects of climate change will fall short of having an impact on themselves, but currently it can be observed increasingly throughout 2019 that this is becoming less of a potential issue. However, much further research is going to be needed to further investigate how we need to prepare young people for the unfolding disaster of climate change.

Lastly, the current generation of "youth" are the first generation where climate change is a scientific claim that is accepted at both the scientific and much of the political level. Despite this, there has been questions raised in American academic literature as to whether there is a current "climate spiral of silence" (Maibach *et al.*, 2016 p.1), and this raises questions around whether it has links back to the issues surrounding cognitive development? This means that young people are not willing to talk about climate change actively. Whilst there is no certainty that this concept carries over to the United Kingdom, it does raise questions as to whether similar issues about climate communications are occurring amongst British young people.

1.3. Problem Rationale

As introduced, there is a little information currently about the nature of climate change perception and engagement amongst youth within the United Kingdom. This has to date neither been explored in terms of this relationship relative to worldview factors and critical processes of potential intervention such as education and experiential learning.

1.4. Research Aims and Objectives

The aim of the thesis is to investigate youth perception of climate change within the United Kingdom and explore how this can alter climate related engagement and reactions.

The above aim will be accomplished by fulfilling the following research objectives to:

1. Integrate climate change ideas around the themes of perception, engagement, reaction and response, including through socio-economic data.
2. Examine the national curriculum to explore what young people are being taught in relation to climate within the United Kingdom currently.

3. Evaluate the role of a participatory engagement methodology, represented by the Yonmenkaigi System Method, to observe experiential learning and how it may influence perception of climate change.
4. Examine the key relationships in climate change behavioural interactions guided by youth engagement.
5. Investigate how the recent emergence of 'Extinction Rebellion' and the 'School Strike for Climate Change' are influencing understanding of climate change engagement amongst youth.

1.5. Overall Approach to Thesis

The thesis uses a pragmatism research philosophy to investigate the research questions arrived at in Section 4.1. The definition of pragmatism is "a philosophy contending that what counts as knowledge is determined by its usefulness to human agents situated in changing historical and geographical circumstances" (Castree, Kitchin and Rogers, 2013, p.396). This method is particularly useful as this thesis deals with perception and engagement, which are constructed on knowledge.

The research is based on primary and secondary data across a subsection of the United Kingdom Society. In line with the pragmatism approach, mixed methods were applied for primary data collection, with questionnaires, interviews and the Yonmenkaigi System Method. Secondary data collection, including Google Trend data, was used to add further detail to the analysis.

Two questionnaires were used to collect primary data during the process of researching this thesis. The first questionnaire was applied between March and September 2017, with 1,134 filled in questionnaires being collected across the United Kingdom and Crown Dependencies. This was undertaken using a self-filling paper form and an internet-based form using social media, web-forums and targeted emails, using the same questions on both forms. This was undertaken to gather the maximum exposure to the questionnaire. A second questionnaire was undertaken during May and July 2019, with 1,700 usable questionnaires being collected across the United Kingdom. For this round, due to the time limited nature of this survey, the questionnaire was only an internet based form.

Questioning within this thesis is based on or the same as questions from other studies about perception and engagement with climate change to allow cross referencing of findings. However, this study is unique because of the specific focus on young people within the United Kingdom.

1.6. Field Site

The research is fully based within the United Kingdom; but with some data being from other countries within the European Union, which are drawn on for comparison with similar studies from other countries over the last thirty years.

The United Kingdom is expected to experience the effects of climate change, both directly and indirectly, during the rest of this century. Some of effects are more extreme heat waves, such as the ones experienced in the summer of 2018 and 2019; or more flooding events during winter, such as the floods that occurred in Yorkshire in October 2019.

It should be noted that the definition of the United Kingdom within this thesis comprised the four countries that make up the United Kingdom [England, Northern Ireland, Scotland, and Wales], but will also include the Crown Dependency Islands of Isle of Man located within the Irish Sea, and the Bailiwicks of Guernsey and Jersey located within the Channel Sea. The reasoning for including the Crown Dependencies within this study is explained in sub-section 2.2.7 of this thesis.

1.7. Positionality

The author's positionality throughout this thesis is that of a climate change believer. In addition, the author believes that climate change is mainly influenced by anthropogenic activity, but natural processes such as El Niño still have an impact on the climate. Also, the author believes that a lot of climate scepticism has its root influences from the media, as the media is the main resource for the public to gather their scientific information; and, because the media tends to prefer conflicting and sensationalist articles. In addition, the author has a positionality in viewing the United Kingdom education sector as not doing enough to promote climate change to the youth, instead leaving young adults confused about the processes and effects of climate change.

1.8. Structure of the Thesis

This thesis is broken down into eight chapters, which is demonstrated in Figure 1.1.

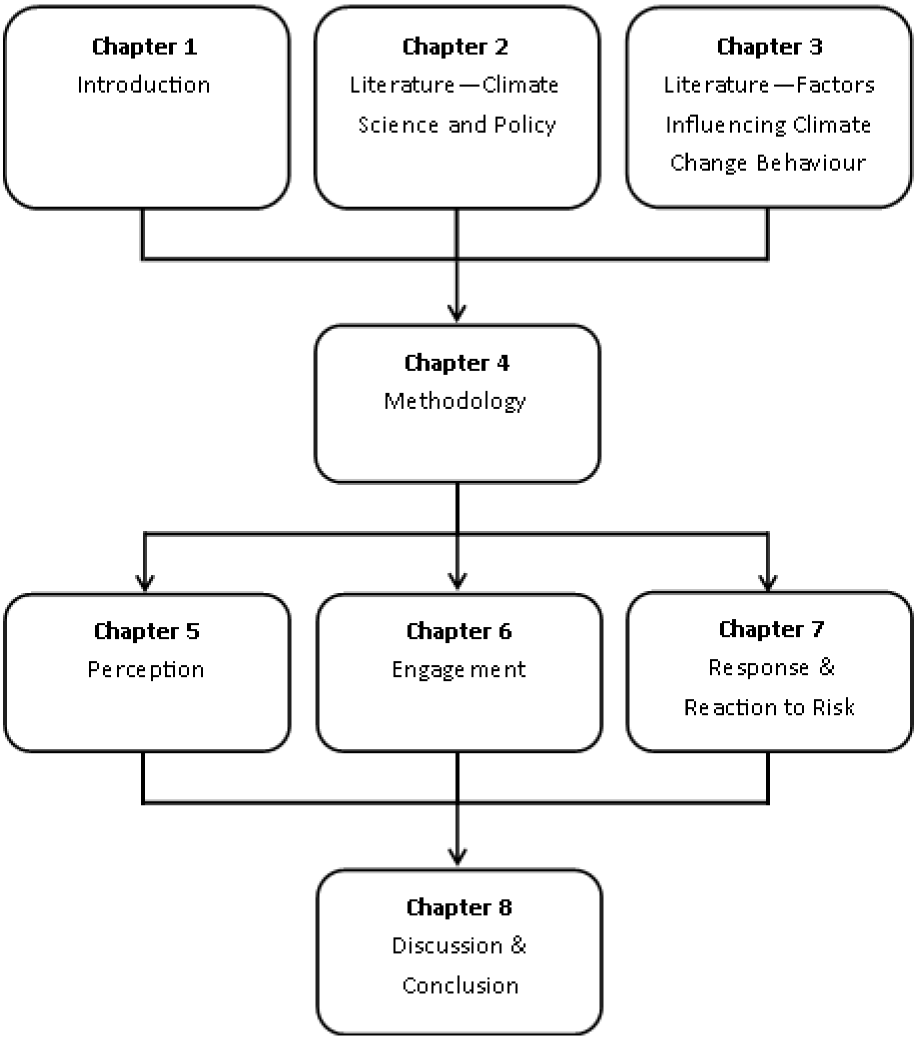


Figure 1.1. – Structure of thesis (Source: Author)

Chapter 2 provides the scientific background of climate change and how that has informed policy both at a national level within the United Kingdom and internationally.

Chapter 3 examines the extensive body of literature in relation to the theme of climate change engagement literature to provide an in-depth analysis of how the public engage with issues of climate change. This chapter highlights the research dedicated to climate change, awareness of climate change, climate sceptics, reaction to risk, vulnerability, education, experimental learning and the psychology of adolescents. Additionally, the chapter will also explore the different aspects of how the public form their world view. Lastly, this chapter presents the conceptual framework that has been developed from an explorative literature review. This conceptual framework helps to guide the direction of the research informing the thesis.

Chapter 4 describes the different methods that have been used within this thesis including providing an overview of both the methodological philosophy and approach. Each of the research methods that have been used are explored in detail; in which consideration to both the contributions and limitations of each method is addressed. In addition, this section considers the ethical challenges that occurred during this thesis; this includes issues around stereotyping and sexist language.

Chapter 5, 6 and 7, contains an overview of the data that has being collected within this research project and analyses this data using the methods that have been identified within chapter 4. The findings are split into three chapters to demonstrate the three main areas of research within this thesis.

Chapter 5 explores the public's perception of climate change within the United Kingdom, focusing on youth. This includes how the British public believe climate change compares to both other societal and environmental issues. In addition, it explores whether the public believe that climate change is occurring and by how much. Lastly, it explores what the British public are thinking of different institutions in relation to communication of climate change and what they think of different policy responses that the United Kingdom government are making in combatting climate change.

Chapter 6 explores public engagement of climate change within the United Kingdom, again focusing on youth predominantly. This includes looking at the levels of education that the questionnaire respondents have received about climate change in formal education. As a way to test whether more engagement techniques might yield more positive results in term climate change perception and understanding, a Yonmenkaigi System Method was undertaken, which included critical observation from this experiment. The chapter also explores the different techniques that the questionnaire respondents have undertaken within the last three years in mitigating against the effects of climate change.

Chapter 7 explores the public's reaction towards extreme climatic conditions that climate change is causing and/or is going to cause to the United Kingdom in the future. This was undertaken by examining how many of the questionnaire respondents have been affected by extreme meteorological events within the last five years. Also, it was done using YouGov surveys and how the public viewed different weather events in relation to climate change. In addition, this also focuses on the response of the public to what this thesis introduces as a "Post-Normal Engagement", and how in this framing they both positively and negatively viewed 'Extinction Rebellion' and 'School Strikes for Climate Change'.

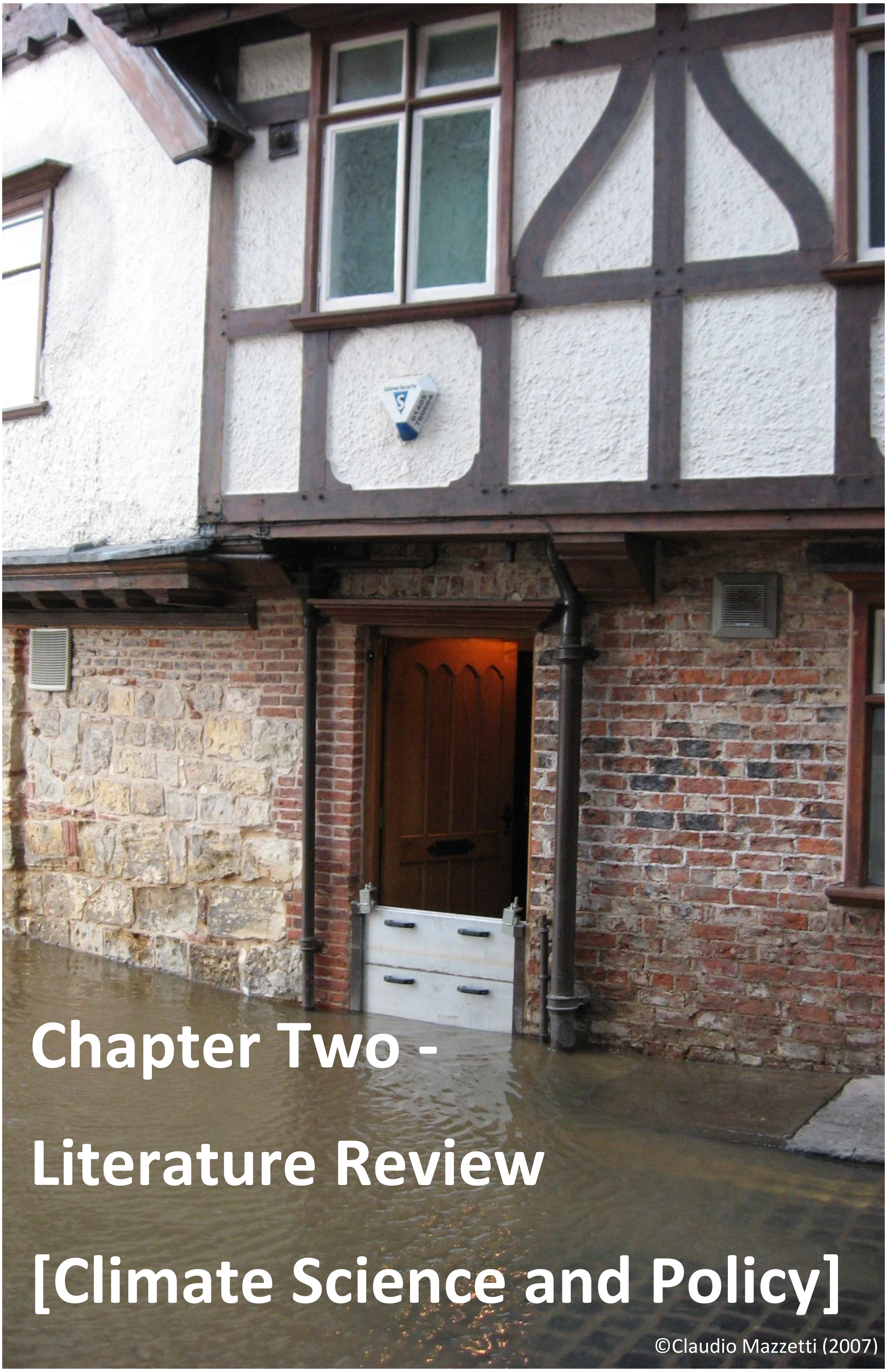
Chapter 8 encompasses both the discussion and conclusion of this thesis. This chapter discusses the major findings in chapter five to seven and what are the implications of the findings in terms of theory, methodology, policy and conceptual the ongoing conceptual framing of this topic. In addition, this chapter puts forward a number of policy recommendations for engagement of the public in climate change related issues, as well as identifying areas for future research. Lastly, this chapter will outline potential limitations of the research.

1.9. Significance of Study

The importance of this thesis in terms of perception is that young people have a tendency to be concerned about climate change and how it will impact on their future. However, this study demonstrates that the level of concern in 2019 is at its highest point since at least 2008. In addition, it demonstrates that there was at least two social tipping points amongst young people that had impacts which have demonstrated short and medium-term impacts on concerns about climate change. It is demonstrated however that young people in the United Kingdom are on average less concerned about climate change compared to the rest of the European Union.

The importance of the thesis in terms of climate change engagement is demonstrated in that, whilst young people acknowledge that climate change is a fundamental issue that society faces, their ability to mitigate is weaker compared to other groups. This is due to the lack of available financial resources that they have, meaning that they are restricted to more basic methods, such as turning off unused lights and walking to university and/or work more, which do not necessary have the greatest impact. In addition, it is found that the education that young people are receiving about climate change could be described as diluted at best, as demonstrated within the current curriculum's limitation in addressing climate change. This is despite past research and the international community highlighting the importance of education in preparing young people for the future.

In terms of the "response" chapter of this thesis, despite the potential perception and media coverage that young people are becoming the new driving force of the climate movement within the United Kingdom, there is suggestions from this study that a greater number of young people have not heard of 'Extinction Rebellion' and 'School Strike for Climate Change'. However, younger people were more likely to support the civil disobedience; this demonstrated that significant number of people (more towards the younger end of the scale) may be ready for an escalation of non-violent action that could force change in the systemic and structural determinants of crises in the UK and elsewhere. The findings here are to expand our understanding of the nature of societal engagement in the climate debate and related disaster risk reduction.



Chapter Two - Literature Review [Climate Science and Policy]

©Claudio Mazzetti (2007)

"Today we're seeing that climate change is about more than a few unseasonable mild winters or hot summers. It's about the chain of natural catastrophes and devastating weather patterns that global warming is beginning to set off around the world … the frequency and intensity of which are breaking records thousands of years old"

Barack Obama (2006)

44th President of the United States of America

Cited in Olive (2008)

In recent years, there has been a significant interest of the climate change sub-sector within each of the geography, psychology and sociology disciplines. This is due to more extreme climatic events occurring globally, the implications of the Paris Agreement signed in November 2015, and the mass climate activism organised by Extinction Rebellion and School Strike for Climate Change, both within the United Kingdom and internationally. To understand why this topic is relevant to scholarly investigation, it is important to place climate change in the context of past and present academic literature. This and the next chapter will critically examine the literature of climate change in terms of the scientific basis of climate change, the political lens of climate change, the comprehension of climate change, factors influencing perception, climate scepticism, education about climate change, the media coverage of climate change, the role of experiential learning, and environmental activism.

These themes and theories will be considered within the research presented via the forthcoming chapters. Lastly, this section will set out the research questions that this thesis addresses. Figure 2.1 demonstrates the structure of this and the next chapter, and shows that there are six main sections within these chapters.

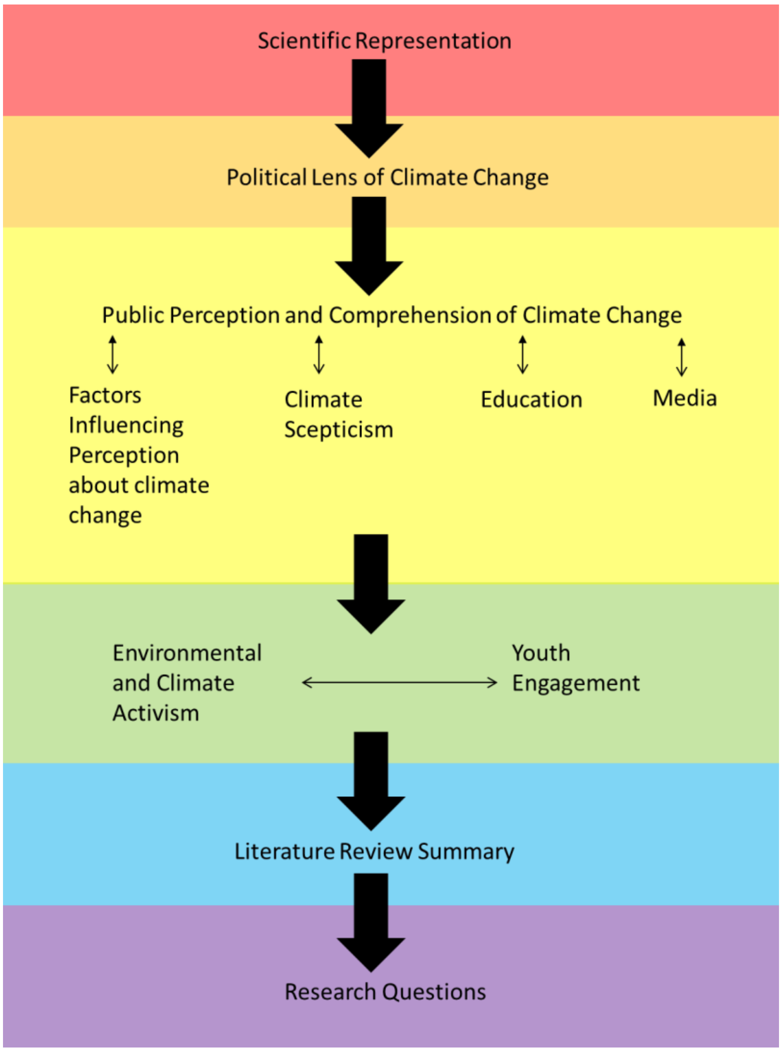


Figure 2.1 – Structure of Chapter Two and Three [Literature Review] (Source: Author)

2.1. Scientific Representation of Climate Change

Climate change is not a new phenomenon; the temperatures of the planet have regularly changed throughout its history. For example, during the Last Glacial Maximum, about 21,000 years ago, the temperatures were between 3°C and 5°C colder than present (Alexander *et al.*, 2013). At the other end of the scale, the Paleogene-Eocene Thermal Maximum, which was about 55.5 million years ago, it was estimated to have been between 6°C and 8°C warmer than today (McInerney and Wing, 2011; Meissnet *et al.*, 2014). These examples were attributed to natural forcings. Some examples of natural forcings are the Milankovitch cycle (Hays, Imbrie and Shackleton, 1976; Berger, Loutre and Mélice, 2006), solar activity (Bond *et al.*, 2001; Zharkova *et al.*, 2019), and volcanic activity (Bryson and Goodman, 1980; Robock, 2000). These natural forcings will be further explored in Section 3.3.2 of this thesis, in relation to how deniers refer to these as natural phenomenon in order to deny the existence of anthropogenic climate change.

As of 2018, research demonstrates that the planet has already warmed up by 1°C since 1880 (IPCC, 2018). This represents an increase of 0.07°C per decade. However, the rate of warming per decade has been increasing, with a warming increase of between 0.15°C and 0.20°C since 1975 (NASA, No Date). As a consequence of this increasing warming rate, it is estimated that since 1880, two thirds of the temperature increases have occurred in the last forty-five years (NASA, No Date). The temperature increase coincides with the rise of greenhouses gases since the industrial revolution[2] suggesting there is a link between the two. This relationship between greenhouse gas emissions and temperature is demonstrated within Figure 2.2.

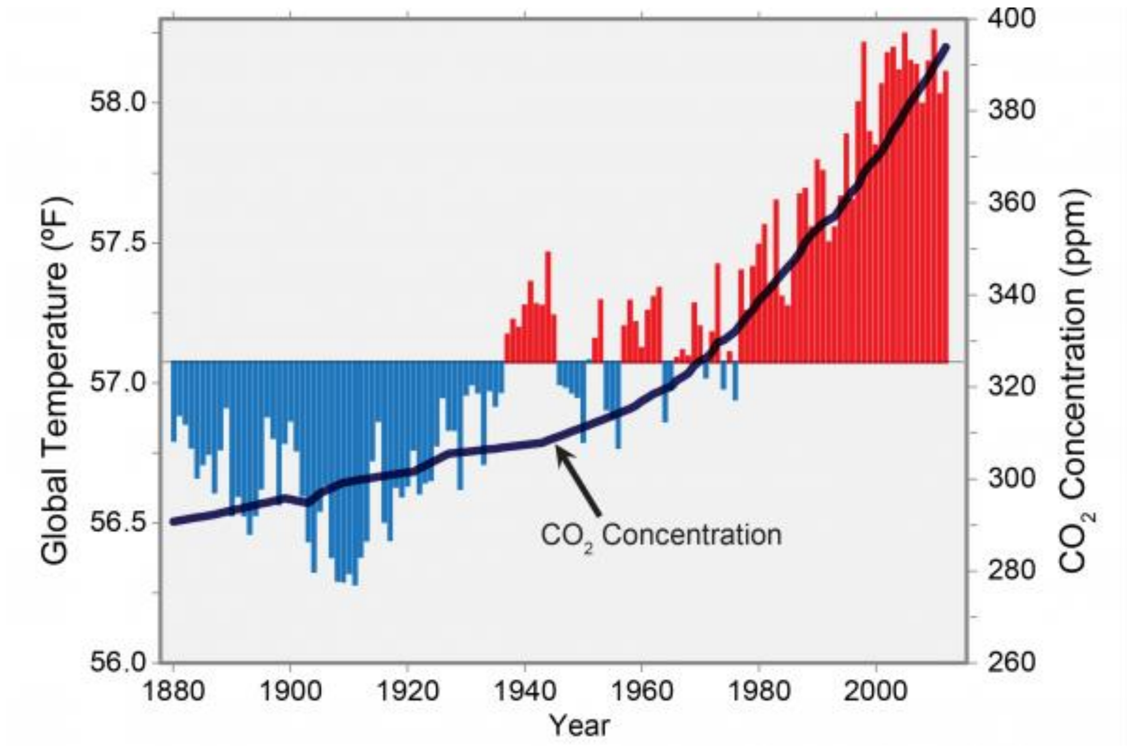


Figure 2.2 – Global temperatures in °F and carbon dioxide concentrations in ppm between 1880 and 2012 (Source: Walsh et al., 2014, Online)

[2] - The Industrial Revolution was a period of change in society, between 1760 to c.1840, which led to the introduction of industry and the first introduction of machines. This period of history also experienced a rise in greenhouse gases, such as carbon dioxide (Neftel *et al.,* 1985; Friedli *et al.*, 1986; Keeling *et al.*, 1995; Etheridge *et al.*, 1996; Andres *et al.*, 1999) and methane (Badr, Probert and O'Callaghan, 1992). These increases are due to the fuel needed to either create or run machines (Keeling, 1973; Keeling *et al.*, 1995), and through climate change feedback such as the Arctic methane release (Schuur *et al.,* 2015; Dean *et al.,* 2018; Lewkowicz and Way, 2019; Turetsky *et al.,* 2019; Turetsky *et al.,* 2020).

Whilst the effects of greenhouse gases have being studied since the early 19th century (Tyndall, 1861); it was not until 1957 that the link between greenhouse gases and atmospheric and oceanographic temperatures was proven (Revelle and Suess, 1957). Greenhouse gases absorb thermal radiation which is emitted from the Earth's surface, therefore trapping this thermal radiation (EPA, 2015). This results in a build-up of greenhouse gas emissions, which acts like a blanket to keep the Earth warm (Houghton, 2004). There are different greenhouse gases within the Earth's atmosphere. Examples of some greenhouse gases are carbon dioxide, chlorofluorocarbons, methane, sulphur hexafluoride, ozone, and water vapour. Table 2.1 demonstrates a quantity of these gases within the atmosphere and the global warming potential [GWP][3] for different greenhouse gas emission[4].

Table 2.1 - Greenhouse Gas Quantity in the Atmosphere and Global Warming Potential over 100 years (Adapted from Myhre et al., 2013; EPA, No Date).

Greenhouse Gas	Parts per Billion (ppb)			GWP over 100 years
	2005	2011	Change	
Water Vapour	18,000,000		-	-
Carbon Dioxide	379,000	391,000	3.17%	1
Methane	1,774	1,893	6.71%	25-34
Nitrous Oxide	319	324	1.57%	298
Ozone	337		-	-
Chlorofluorocarbons (CFCs)		0.837 (Overall) 0.527 (CFC-12)		10,200 (CFC-12)
Hydrofluorocarbons (HCFCs)		0.278 (Overall) 0.231 (HCFC-22) 0.024 (HCFC-23)		1,760 (HCFC-22) 14,800 (HCFC-23)

Source: Adapted from Myhre *et al.* (2013) and EPA (No Date)

Full table of all greenhouse gas emissions and GWP are located with Appendix E

[3] - Global Warming Potential is a method to compare the warming impacts of different gases. GWP is the comparison to carbon dioxide. For example, a GWP of 20 means for every ton of the select greenhouse gas, it will have same impact of releasing 20 tonnes of carbon dioxides. (EPA, No Date).

[4] - For a full list of Greenhouse gases and their potential can be found within the latest Intergovernmental Panel on Climate Change [IPCC] report (Myhre *et al.*, 2013).

As demonstrated in Table 2.1, carbon dioxide and water vapour are the most abundant within the Earth's atmosphere (Pidwirny, 2006), whilst chlorofluorocarbons and hydrofluorocarbons been the most potent[5]. Greenhouse gases, such as Water Vapour, Carbon Dioxide, Methane and Ozone are naturally occurring and are fundamental for life to exist on the planet. For example, without these greenhouse gases the average surface temperature of the Earth would be -18^{o}C (Ma, 1998), which is roughly 33°C cooler than its current surface temperature.

The levels of these gases have increased since the Industrial Revolution due to anthropogenic causes. In particular, it has been observed that the levels of carbon dioxide have been rising rapidly. The observatory at Mauna Loa, in Hawai'i, has the most comprehensive record for instrument recorded carbon dioxide in the world after been started by Charles David Keeling in March 1958 (Keeling *et al.*, 1976). It was at this observatory that it was observed that carbon dioxide emissions were rising (Keeling, 1960). The emission levels at the Mauna Loa Observatory have risen from 315.97 parts per million [ppm] in 1959 to 411.44 ppm in 2019[6] [7] (NOAA, 2020), which represents a rise of 30.21 per cent during this 60 year time period. This demonstrates that the rate of increase of carbon dioxide emissions has been increasing in recent years, with an increase of 3.41 ppm in 2016. This is nearly a full 1ppm more than any other point before 2010. This can be attributed to carbon dioxide levels being emitted by human activity and is still increasing (Le Quéré *et al.*, 2018).

Some researchers believe that the increase of carbon dioxide is due to carbon sinks[8] becoming clogged up (Canadell *et al.*, 2007), but this belief is still highly contested. If natural sinks have not slowed down

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[5] - Within this thesis, potent means the power in terms of potential to do the most harm to the environment.

[6] - Carbon dioxide levels naturally fluctuate during the year. This fluctuation is due to a number of factors, which are a mix of natural and anthropogenic. For example, hibernation of trees during the winter months results in the reduced ability to absorb as much carbon dioxide. An example of the anthropogenic activity causing increasing carbon dioxide levels in the atmosphere in the winter months would be an increase usage of electricity and gas throughout the Northern Hemisphere for light and heat, due to less daylight hours and colder temperatures (Stouffer and Wetherald, 2007). However, there is a lag in the change of carbon dioxide, and as a result these gases tend to peak in May. This means that emissions peak during the winter months. It should be noted, that as a result of less population and land mass within the Southern Hemisphere the fluctuation of greenhouse gases are less pronounced there.

[7] - See Appendix F for a full list of greenhouse gas emission between 1959 and 2019 at the Mauna Loa Observatory.

[8] - Carbon sinks are defined by Mayhew (2015) as a phenomenon in which atmospheric carbon dioxide is absorbed. This process is also known as carbon sequestration and can be achieved through both natural and human processes. Examples of natural processes are those of the soil (Ciais *et al.,* 2013a; Ciais *et al.*, 2013b; Le Quéré *et al.*, 2018; Varjani, Humbal and Srivastava, 2019), forests (Dixon *et al.*, 1994; Pacala *et al.*, 2001; Janssens *et al.*, 2003; Pan *et al.*, 2004; Piao *et al.*, 2005; Dybala *et al.*, 2019; Varjani, Humbal and Srivastava, 2019) and

in absorbing carbon dioxide, it raises the issue that there will come a point in the future in which natural sinks will not be able to absorb carbon emissions at the current rate. Consequently, if society does start reducing its greenhouse gas emissions through mitigation, the rate of change of carbon dioxide is going to keep increasing. It is expected by climate scientists that by 2050, carbon dioxide levels could reach 550 ppm (Meinshausen, 2006; Fisher *et al.*, 2007; Marchal *et al.*, 2012). This would represent a rise of a 58.24 per cent on 1959 levels. It will also be the first time carbon dioxide levels will be at their highest levels during the last 25 million years[9] [10] (Zhang *et al.*, 2013). It has been noted that global carbon dioxide emissions before the start of the Industrial Revolution were roughly 280ppm (Zalasiewicz *et al.*, 2008; Monastersky, 2013; Varjani, Humbal and Srivastava, 2019). These changes demonstrate that because of human activity, the planet is entering a new epoch series, which some academics are calling the "Anthropocene" epoch (Zalasiewitz *et al.*, 2008; Smith and Zeder, 2013; Lewis and Maslin, 2015; Waters *et al.*, 2016), but it is still to be recognised as an epoch by either the International Commission on Stratigraphy or the International Union of Geological Sciences (Edwards, 2015; Subramanian, 2019). Further information about other greenhouse gas emission is available in Appendix E and in the latest IPCC report (Myhre *et al.*, 2013).

Whilst the average global temperatures have risen by one degree Celsius [°C] between 1880 and 2018 (McGrath, 2019), it has further been observed that global temperatures in 2014, 2015, 2016, 2017 and 2018 were the five warmest years in recorded history (NOAA, 2017; Cole and McCarty, 2018; Cole, 2019). It should be noted that whilst 2017 was not the warmest year on record, but the second warmest, it was, however, the warmest non-El Niño year on record, with the previous two warmest years [2015 and 2016] being when El-Niño helped push up global temperatures[11]. However, this warming of global temperatures does not occur equally across the planet. It was found by Bekryaev, Polyakov and Alexeev (2010) that average temperatures at the poles are raising at the fastest rate globally. This is demonstrated by a temperature rise of 1.38^{o}C per century between 1879 and 2008 in

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seas (Palmiéri *et al.*, 2015; Meyer *et al.*, 2018). Examples of proposed human carbon sinks are ocean sequestration (Robinson *et al.*, 2014); ocean iron fertilization (Robinson *et al.*, 2014); mineral sequestration (Xu, Apps and Pruess, 2005; Gislason *et al.*, 2010); and geological sequestration (Holloway, 1997).

[9] - The planet last observed greenhouse gas emissions at the 550ppm level roughly 25 million years during the Oligocene epoch. Global temperatures during this period were between 4^{o}C and 6^{o}C warmer than the average global temperatures between 1960 and 1990 (Hansen *et al.*, 2013).

[10] - It should be noted that Homo sapiens (humans) have only been around for the last 200,000 years (Hammond, Royer and Fleagle, 2017); which means that humans are already experiencing the largest concentration of carbon dioxide emissions in the species' history; with it expected to continue to increase.

[11] - See section 3.3.2 about natural processes affect climate change including El Niño.

the Arctic, which was twice as much as the rest of the Northern Hemisphere. This is demonstrated in Figure 2.3, which shows that during 2018, parts of the Arctic were up to 4°C above average temperature between 1951 and 1980 period; which can be attributed to local processes, such as surface albedo (Holland and Bitz, 2003; Serreze and Francis, 2006; Serreze *et al.*, 2009; Pistone, Eisenman and Ramanathan, 2019).

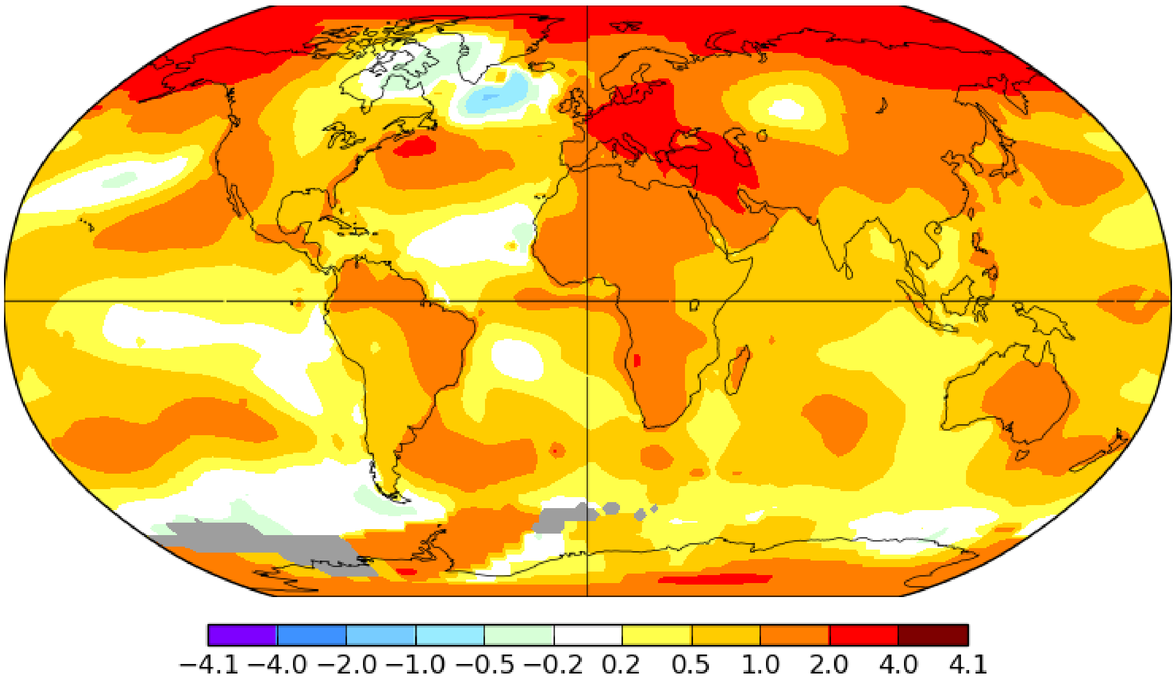

Figure 2.3 – Average temperature [°C] in 2018 compared with the 1951 to 1980 average (Source: NASA, 2019, Online)

It should be noted that carbon dioxide is not the only greenhouse gas emission that has risen in the past few decades. Others include, but are not limited to methane (Mitchell *et al.*, 2013; Worden *et al.*, 2017; Howarth, 2019), hydrofluorocarbons (Lunt *et al.*, 2015; Montzka and Velder, 2019; Stanley *et al.*, 2020), and sulphur hexafluoride (Dervos and Vassiliou, 2000). As demonstrated within Table 2.1, whilst these gases are scarce within the atmosphere, they are highly potent in relation to carbon dioxide.

As a consequence of these types of greenhouse gases continuing to rise within the atmosphere, it is expected that atmospheric and oceanographic temperatures will continue to rise for the forthcoming decades. It has been projected by the Alexander *et al.* (2013) that global temperatures are likely to increase between 0.3°C and 4.8°C during the 2080-2100 period in comparison compared to the recorded period between 1986-2005; depending on the increase of greenhouse gases in the atmosphere within the coming decades. But, as highlighted previously, these changes in temperatures are not going to be equally distributed.

2.1.1. Climate Change at the National Level

Within the United Kingdom, the average temperatures have risen by 1°C in the past century (DECC, 2014). However, the temperature increase has not been constant, with 0.5°C occurring in the last 30 years (DECC, 2014). In 2014, the Met Office estimated that average temperatures in the United Kingdom will continue to rise, with projected temperatures in 2100 expected to be up to 3°C warmer in the south of England and 2°C warmer in Scotland; compared to averages between 1960 and 1990 (DECC, 2014). However, whilst these estimates will depend on various factors, for example the levels of greenhouse gases in the atmosphere, the changes also depend on environmental mechanisms such as the Atlantic thermohaline circulation[12].

As a consequence of this warmer climate, the atmosphere will have the ability to retain more moisture (Lenderink and van Meijgaard, 2010) and the precipitation frequency and intensity will alter within the United Kingdom with expected climate change. The United Kingdom annual rainfall totals have not changed significantly in recent years (Jenkins, Perry and Prior, 2008); however, there has been an increase in the amount of extreme precipitation/storm events during the winters in the last 50 years (Osborn and Hulme, 2002; Jenkins, Perry and Prior, 2008; Maraun, Osborn and Gillett, 2008; Burt and Ferranti, 2011; Jones *et al.*, 2013; Jones *et al.*, 2014).

It is not just warmer average temperatures that the United Kingdom will experience due to climate change. The following section will explore some of the expected effects of climate change within the United Kingdom.

2.1.2. Impacts of Climate Change within the United Kingdom

The Met Office (No Date a) highlight that there are thirteen different impacts that climate change will have on the United Kingdom. The following bullet points highlights what these are, what they mean and some examples.

1. Change in Seasonality – It has been observed that seasonality has changed in the last 70 years. Within the Northern Hemisphere it is observed that leafing is occurring at 1.2 days per decade

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[12] - This process is described in further detail within Appendix G

earlier, whilst the last spring frost is occurring at 1.5 days per decade earlier (Schwartz, Ahas and Aasa, 2006).

2. Heat Stress - Typically, heat waves within the United Kingdom are not frequent, but still occur. Famous examples are during the summers of 1976, 2003, 2018 and 2019. During these heatwaves, the chances of heat stress amongst the public increases. It is most likely to affect the very young and elderly. During the 1976 heatwave, there was 20 per cent increase in the mortality rate, and a 56 per cent increase in 2003 for people over the age of 75 within London (Johnson *et al.*, 2005; Kovats, Johnson and Griffiths, 2006).

3. Habitable Region of Pests Expand – Increasing temperatures will result in the ability of pests to spread further. Research demonstrates that the United Kingdom will see an increase in the number of insect pests already within the country, with a number of new migrant pests (Cannon, 1998).

4. Forest Mortality and Increased Risk of Fires – Temperatures are expected to be warming in the summer months with the combinations of dryer conditions during the same period within the United Kingdom. This establishes more ideal conditions for forest and moorland fires. In the past two years, the United Kingdom has observed a couple of relatively large moorlands fires on Saddleworth Moor, Greater Manchester; Winter Hill, Lancashire and Ilkley Moor, West Yorkshire. It estimated that the two years resulted in over 470km^2 being burned within the United Kingdom (Houses of Parliament, 2019).

5. Damage to Infrastructure – 2019 demonstrates that elements of the United Kingdom infrastructure are unprepared for 1^{o}C increase in temperatures, but that temperatures are expected to rise. An example of the impact includes, for example, the threatened collapse of Whaley Bridge Dam in Derbyshire in April after intensive rainfall in the preceding days (CCC, 2019). But, it is not just rainfall, but also the high temperatures that puts at risk the United Kingdom's infrastructure; demonstrated by power outages, roads melting and rail line buckling during the heatwave in 2019 (BBC, 2019a; Middleton, 2019)

6. Food Insecurity - Climate change can affect the food supply of the country either directly through crop failure (Challinor *et al.*, 2014), or indirectly through increased food prices volatility caused by a decreased food supply globally (Kalkuhl, von Braun and Torero, 2016).

The majority of the planet, especially close to the Equator, will see a reduction in agricultural output by the 2080s, based on 2003 levels; whilst, the United Kingdom as a whole is likely to experience a reduction in agricultural output between 0 and 5 per cent by the 2080s, based on 2003 levels (Cline, 2007). In addition, it is expected that global population will continue to rise throughout this time, which will only increase pressure on crop resources.

7. Risk to Water Supplies – More seasonal rainfall expected within the forthcoming years, is expected to raise the risks to water supplies, especially in the South East of England which already has a population stress upon their water supplies and is expected to increase (BBC, 2019b).

8. Conflict and Climate Migrants – As countries closer to the equator become warmer and dryer, the likelihood of crops failing and droughts occurring will increase. These slow onset disasters can lead to “displacement and forced migrations” (Collins *et al.*, 2017); in addition to conflicts over water supplies both within and between nation states (Gleick, 1993; Gleick, 1994; Yoffe, Wolf and Giordano, 2003; Wolf, 2007). Some researchers already believe that the Syrian Civil War[13] was caused in part due to a prolonged drought (De Châtel, 2014; Gleick, 2014), which has sparked a debated whether climate change has contributed to the conflict (Femia and Werrell, 2012; De Châtel, 2014; Gleick, 2014; Kelley *et al.,* 2015; Selby *et al.,* 2017; Daoudy, 2020). It is widely predicted that the United Kingdom and the rest of Northern Europe will see continue levels of migrations from the Middle East and Africa (Black *et al*., 2011).

9. Localised Flooding - In a warmer climate, it is expected that the more intensive rainfall events will occur (Allen and Ingram, 2002). It has been observed in Donat *et al.* (2016) that the increase in extreme rainfall events in recent years has been due to climate change. During the 2007 flooding events across England, a report by the Environment Agency highlighted short but intensive rainfall that kept repeating every few days, which accumulated. For example, parts of the North Yorkshire Moors received four times the normal rainfall for June; and parts of Worcestershire received six inches of rainfall in just two days (EA, 2007). During the floods, the situation was described by the Environment Agency as “critical” (BBC, 2007a).

[13] - In drought affected Syria between 2006 and 2009, it is estimated that roughly 800,000 people lost their livelihood and that 1.3 million people in Eastern Syria were affected (Solh, 2010). It was estimated by ACSAD (2011) that this region of Syria lost 47 per cent of wheat production and 67 per cent of barley production, in addition the livestock population significantly contracted.

10. Flooding of Coastal Regions – Lowe *et al.* (2009) highlight that they could be a sea level rise difference within the United Kingdom of 25 centimetres by the end of the century, with the raise not been uniform as most will occur in the South of England. As a consequence, storm surges are likely to put more people at the coastline in danger of flooding.

11. Damage to Marine Ecosystems - In the last few decades, there has been a steady decrease in the pH of the Earth's Ocean, which has been attributed to increase levels of carbon dioxide within the atmosphere (Caldeira and Wickett, 2003). It is estimated that between 30 and 40 per cent of extra carbon dioxide produced through anthropogenic activity is been absorbed by waterbodies (Millero, 1995; Feely *et al.*, 2004). Increasingly acidity has harmful repercussions for marine life. An example is 'coral bleaching' (Hoegh-Guldberg *et al.*, 2007).

12. Fisheries Failing – Increased acidification of waterbodies also result in increased extinction rates amongst fish (Schofield, 1976; Rask and Tuunainen, 1990; Tremblay and Richard, 1993; Baldigo, Roy and Driscoll, 2016).

13. Loss of Biodiversity - most researchers believe that the Earth is currently in its sixth mass extinction. They state that the current extinction rate, since 1900, is occurring at a rate between 100 and 1000 times above normal (Pimm *et al.*, 1995; Pimm *et al.*, 2014; De Vos *et al.*, 2015). Many researchers dub it as either the Holocene Extinction or the Anthropocene Extinction (Sodhi, Brook and Bradshaw, 2009; Dirzo *et al.*, 2014; Ceballos *et al.*, 2015; Ceballos, Ehrilch and Dirzo, 2017).

2.1.3. Overview

As this section has demonstrated, the science shows that the planet is already seeing initial impacts of climate change. But it also shows that the impacts of climate change could get much worse in the future. In addition to this, over the last thirty years, climate change has emerged to become a major issue for society, especially as a political and social issue. Consequently, the following two sections will examine climate change within the United Kingdom through a political and social lens respectively.

2.2. Political Lens of Climate Change

The issue of climate change was given political legitimacy early in the climate change debate in the late 1980s by a couple of key events and led Hulme (2009) to state that 1988 was the year which climate change took off in the western civil society conscience. The first occurred on the 23rd June 1988, when NASA scientists, Dr. James Hansen testified before the United States Senate Committee on Energy and Natural Resources. Within the testimony, Hansen stated that "global warming has researched a level such that we can scribe with a high degree of confidence a cause and effect relationship between the greenhouse effect and observed warming … it is already happening now" (Shabecoff, 1988, pp. A1, A14). A number of researchers agree that this testimony increased public awareness of climate change (Weart, 2008; Besel, 2013; Holmes, 2015) and allowed the issue of climate change to enter the public discourse, not just within the United States, but globally. It also archived bringing the political/policy issue to the forefront (Besel, 2013); and some argued that in principle this occurred overnight (Wilford, 1988).

The second was the two speeches that the then British Prime Minister, Margaret Thatcher, gave on the issue in 1988 and 1989. The first she gave to the Royal Society; to which she referred to humankind having "unwittingly began [a] massive experiment with the [climate] system of this planet itself" (Thatcher, 1988, Online). The second speech was given to the United Nations in November 1989, in which she dedicated the whole speech to global environmental issues, specifically focusing on different elements of climate change. She was the first political leader to openly discuss and raise awareness of the issue (Nulman, 2015); but it is arguable whether she helped push climate change up the international agenda. Nevertheless, it demonstrated that the United Kingdom was at the forefront of recognising climate change from the beginning of international action.

As a consequence of this shifting focus on climate change in mid to late 1980s by the scientific and political communities, the Intergovernmental Panel on Climate Change [IPCC] was created in 1988 by both the World Meteorological Organization [WMO] and the United Nations Environmental Programme [UNEP]. Any state that is a member of either the WMO or UN can be/are members of the IPCC. The main object of the IPCC "is to provide governments at all levels with scientific information that they can use to develop climate policies [and the] … IPCC reports are also a key input into international climate change negotiations" (IPCC, No Date a, Online). As a consequence, the IPCC has been described by Besel (2013) as a hybrid scientific body and a political organisation. The most recognised output of the IPCC organisations is the reports that are produced every five to ten years, to provide detailed analysis of the reviewing of the latest climate science. The latest report [AR5] was released in 2013-14; with the next due to be released in 2021-2022. However, on occasion, the IPCC will release special reports on a myriad of different topics related to climate change. For example, the

IPCC released a report called "Global Warming of 1.5°C" in 2018, which looked at the impacts of climate change at a 1.5°C increase based upon pre-industrial times; or the "Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation" [SREX] in 2012, which was an exhaustive assessment on the risks that climate change poses and a range of options which different organisation and communities can choose to reduce the vulnerability from climate change and thus increasing resilience.

The latter of the two examples earlier paved the way for the United Kingdom to shape its policy around the issue of climate change, from the international, national and regional levels. The following subsections will explore the key policies at both the national and international level that have been brought forward in the past thirty years to combat climate change within the United Kingdom and Crown Dependencies; and to demonstrate the changes of carbon emission both within the United Kingdom and internationally due to these changes.

2.2.1. Policy – United Kingdom's Engagement Internationally

The United Kingdom has a long history of dealing with climate change internationally in the past thirty years. This section will explore what the United Kingdom has undertaken and agreed upon to combat climate change.

In 1992, the United Kingdom signed a voluntary agreement at the 'United Nations Framework Convention on Climate Change'[14]. This outlines a target that the United Kingdom's emissions in 2000 would be no greater than 1990 levels (UNFCCC, 1992; DoE, 1994). In addition, it paved the way for the annual Conferences of the Parties [COP] meetings. These meetings have the sole purpose to assess the progress in dealing with climate change; with the first taking place in 1995.

It was and still is important for global issues, such as climate change, to be addressed at the international level with cooperation between different sovereign nations (Rosen, 2015). It has been proven in the past that environmental and societal issues have either been solved or are on their way to been so through this international cooperation. Quintessential examples of this success are reflected by the 'Vienna Convention for the Protection of the Ozone Layer' in 1985, and the 'Montreal

[14] - The 'United Nations Framework Convention on Climate Change' is an international environmental treaty that was signed during the Earth Summit held in Rio de Janeiro between the 3rd and 14th June 1992. This treaty came into effect in May 1994, and was ratified by all 197 members' states of the United Nations; also Palestine, Niue, Cook Islands and the European Union.

Protocol on Substances that Deplete the Ozone Layer' in 1987 both of which were designed to slow down and stop the hole that had appeared in the ozone at the south pole (Benedick, 1998; Oberthür, 2000; Behringer and Heydel, 2019); and public health issues, such as polio and small pox (Fenner *et al.*, 1988; Aylward *et al.*, 2003; Roberts, 2004; Barrett, 2007; Hampton, 2009).

COP meetings have resulted in non-binding international agreements in setting targets to reduce greenhouse gas emissions, such as the Kyoto Protocol. It is argued that this process had been based on the ozone layer protection that had occurred in the previous decade (Oberthür, 2001).

In 1997, the United Kingdom signed the Kyoto Protocol, which became the first legally binding agreement to address climate change. This was an international agreement which required the United Kingdom to make a 12.5 per cent reduction on its greenhouse gas emission by 2012 compared to 1990 levels. In 2012, this agreement was further extended with the Doha Amendment which raised the reduction of greenhouse gases to 20 per cent by 2020 (UN, 2015)[15]. This was the first protocol that had the overarching goal to reduce greenhouse gas emissions being emitted in the atmosphere, which of course was a step in the right direction towards the planet reducing the worst impacts of climate change. Professor Jorge Sarsmiento, Princeton University, proclaims that the Protocol has set the "first steps" of carbon reductions and "provides a framework" which can be revisited regularly in the future (quoted in Malakoff, 1997, p. 2048). However, despite this, there have been criticisms of the Kyoto Protocol within both the academic and political communities over the last twenty-three years as to why it will not be successful in the long-term. Arguably the loudest criticisms were the exemptions for developing countries, which allowed them to emit an unlimited amount of greenhouse gas emissions. The United States government felt that it would put the country at an unfair disadvantage in the future compared to newly developing countries (Reynolds, 2001; Sanger, 2001). As a result, whilst the United States signed the Kyoto Protocol in 1998, the change in government in January 2001 meant the agreement was not given ratification, which meant that it significantly impaired the ability of the agreement being effective in reducing greenhouse gas emissions (Li *et al.*, 2004).

At best, the Kyoto Protocol has only offset a fraction of greenhouse gas emissions of developing countries, such as China and India, who have continued to increase their emissions relentlessly for the past twenty-two years since Kyoto.

[15] - This target was agreed collectively with the European Union, see section 2.2.2.

In 2015, all UNFCCC members' states, including the United Kingdom signed up to the Paris Agreement, which was the follow up of the Doha Amendment. The United Kingdom signed this agreement on the 22nd April 2016; and it came into focus on the 18th December 2016. The main goal is to limit global temperature increase to well below 2°C and aim for an ambitious target of 1.5°C above pre-industrial levels and increase ability to adapt to the adverse impacts of climate change (UNFCCC, 2015). It should be noted that the revised emission reduction targets for each member state are due to be announced at the COP26 in November 2020 (BBC, 2019c). However, there is increasing uncertainty surrounding the Paris Agreement since the then President of the United States of America, Donald Trump, announced his country's planned withdrawal. The reason this has caused the uncertainty is that the United States is the second largest greenhouse gas emitter globally behind China. Therefore, the 1.5°C to 2°C target will need the corporation of the United States. However, it should be highlighted that in response the "United States Climate Alliance" (USCA) was founded and contains fifteen states and overseas territories, a non-partisanship coalition that aims to uphold the aims of the Paris Agreement (USCA, No Date); and also has the support of over four hundred cities within the United States (Climate Mayors, No Date). This demonstrates that whilst there are elements of uncertainty, there is still plenty of support at the regional and local level for the Paris Agreement within the United States.

One way to achieve of the Paris targets was realised at COP23, when the "Powering Past Coal Alliance", which was founded and lead by the United Kingdom and Canada, with 25 state and national governments signing up to the alliance (Le Page, 2017); and has since grown to 34 national governments and 33 subnational governments, including Scotland and Wales[16]. The aim of this alliance is to try to phase out the use of coal by 2030 in the Organisation for Co-operation and Development (OECD) and EU countries[17]; and by 2050 for the rest of the world (UK Government, 2017).

Lastly, the United Kingdom has agreed to host the twenty-sixth COP conference in November 2020 within Glasgow, Scotland (UNFCCC, 2019), now postponed to November 2021. This will allow the United Kingdom to demonstrate to the world its commitment in combatting climate change. The next section examines how closely the United Kingdom has worked with the European Union to reduce its greenhouse gas emissions.

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[16] - A list of signed up national and sub national governments is provided in Appendix H

[17] - A list of OCED and EU28 countries is provided in Appendix I

2.2.2. Policy – European Union and Brexit

Whilst writing this section, the United Kingdom has left the European Union on the 31st January 2020 and is currently in a transition phase until the 31st December 2020. The full implications of the United Kingdom leaving will take time to fully understand. However, as this section will partly demonstrate, the United Kingdom receives a large proportion of its policy in relation to climate change from the European Union. This leaves a large uncertainty on whether the United Kingdom will keep European policy in relation to climate change. However, the United Kingdom currently still has the Climate Change Act 2008 to abide to. Despite there being a lot of concern about the future of environmental programmes within the United Kingdom, including climate change, there are some who regard this as also a great opportunity to have greater regulation on environmental issues (Cressey, 2017). The reason for this view is that due to a large bureaucratic system, the European Union is slow to change.

In addition, as highlighted by Carvalho and Fankhauser (2017), the United Kingdom has some of the most ambitious greenhouse gas reduction targets within the European Union, both in the medium and long term. They estimate that the European Union will have to make an additional 4.5 per cent reduction to meet its 2030 targets; which is roughly the equivalent greenhouse gases of both Belgium and Estonia combined. This demonstrates that the European Union might find it more difficult to meet its greenhouse gas emissions without the United Kingdom.

Nonetheless, the European Union has been pushing since the early 1990s for international policy on limiting greenhouse gas emissions (Böhringer, 2014). In 1996, the European Union adopted a target to cap the increase in global temperatures to 2°C, compared to pre-industrial levels (Tol, 2007). This is a target that the UNFCCC adopted nearly twenty years later in 2015.

An example of how the European Union worked collectively to combat climate change is provided in relation to the Kyoto Protocol. The European Union collectively signed the Kyoto Protocol in 1998 that was ratified 2002 with the passing of decision 2002/358/EC. Within the Kyoto Protocol, it is highlighted that the European Union will collectively reduce its greenhouse gas emissions by eight per cent by 2012. It should be noted that when the Kyoto Protocol was adopted, only fifteen countries were members of the European Union. These are commonly known as the EU-15. Appendix J highlights each country's individual contributions to this reduction. It shows that the spread of planned greenhouse gas emissions reductions across Europe were not equal with some countries, such as for example Germany and Luxembourg, being asked to significantly decrease its greenhouse gas emissions. This occurred whilst other countries such as for example Greece and Portugal could significantly increase their greenhouse gas emissions.

The EU-15 overachieved on its goal of an eight per cent reduction in greenhouse gas emissions, as it achieved a reduction of 15.1 per cent (EEA, 2014). This is demonstrated in Appendix J. In addition, only three countries within the EU-15 failed to meet their greenhouse gas emission targets. However, impact assessments commissioned by the European Parliament found that in addition to policies, economic downturns have previously reduced emissions, especially observed in Eastern Europe post-communism (Höhne *et al*., 2009).

In June 2000, the European Union launched the European Climate Change Programme [ECPP], with the purpose of avoiding dangerous climate change. The ECPP's biggest contribution to reduce climate change is the 'European Union Greenhouse Gas Emission Trading Scheme' [EU ETS]. It was launched in 2005. The aim of the policy is to limit the amount of annual carbon dioxide emissions by allocating each participating emitter a certain amount of pollution permits. This is done through the European Union Allowances [EUAs] (Martin, Muûls and Wagner, 2016). The scheme was the first greenhouse gas emission cap and trade scheme internationally (Ellerman and Buchner, 2007) and is still the largest cap and trade scheme (Ellerman, Marcantonini and Zaklan, 2016). All twenty-eight European Union countries plus Iceland, Lichtenstein and Norway are participating in the EU ETS. EU ETS has been divided into a number of different 'trading periods'. The first trading period was between 2005 and 2007. The second trading period was between 2008 and 2012, which was deliberately timed to coincide with the Kyoto Protocol. The third and current trading period started in January 2013 and is expected to finish in December 2020, which coincides with the Doha Amendment.

Another way in which the European Union has tried to combat climate change is promotion of green electricity. As such, in 2009, the European Union agreed on a target that twenty per cent of all energy consumed should come from renewable sources by 2020 under the Renewable Energy Directive 2009/28/EC. In addition to this target, each country was given their own targets. These targets for each country were set depending on the amount of renewable energy produced at the time. Therefore, countries, such as Latvia and Sweden, who already had a large renewable base, were given larger targets than countries such as Luxembourg and Malta.

These mitigation strategies that have been brought forward by the European Union have been working alongside national policy in combatting climate change. These national policies will be expanded on in the next sub-section.

2.2.3. Policy – United Kingdom National Level

The history of climate change policy within the United Kingdom has its origins in 1988 with the then Prime Minister to Margaret Thatcher, who made a speech to the Royal Society (Pearce, 2006). As a consequence, in 1990, the government released a White Paper called 'This Common Inheritance: Britain's Environmental Strategy', which was the first extensive statement on environmental policy within the United Kingdom (Pearce, 2006). Within this white paper, there was a chapter dedicated to the greenhouse effect, which highlighted its processes and the potential consequences.

The United Kingdom signed the Kyoto Protocol in 1998 and as a response to this, in November 2000, the United Kingdom's government launched its climate change programme. Within this programme, the government indicated that it can achieve greater cuts than the 12.5 per cent highlighted within the Kyoto Protocol, and goes further by setting a target of 20 per cent reduction by 2010 based on 1990 levels (DETR, 2000).

In 2008, the United Kingdom became the first country to impose national targets on climate change reduction under the 'Climate Change Act 2008'. This act outlines that the United Kingdom needs to cut at least 80 per cent of its greenhouse gas emissions by 2050, based on 1990 levels. However, the act does not set out individual targets for each region within the United Kingdom (CCC, 2016). This is important as the emissions within each region of the United Kingdom vary, with England emitting the most overall, and Northern Ireland emitting the most per capita. In addition, the act also has four initial climate budgets, each lasting for five years. These are short term targets, which are to enable the United Kingdom to meet its long-term target of 80 per cent reduction. In 2015, the Committee on Climate Change made recommendations of a 57 per cent reduction by 2030 for the fifth climate budget (CCC, 2015). Table 2.2 demonstrates the climate budget reductions that have been agreed by both the Committee on Climate Change and the British Government.

However, in June 2019, the government announced an amendment to the bill, which increases the reduction of greenhouse gas emissions target to 100 per cent by 2050[18]. The United Kingdom became the first Group of Seven [G7] countries to set out legislation targets to become net carbon neutral by 2050 (Walker, Mason and Carrington, 2019). Laurence Tubiana, a French academic and a key architect of the 2015 Paris Agreement, said the commitment by the United Kingdom will "reverberate right around the world … [as a result] … all eyes will now turn on the rest of the EU to match this pledge" (Harrabin, 2019, Online). However, it is yet to be announced how this will impact on carbon budgets within Table 2.2., but it is possible that the United Kingdom will need to change at least the fifth carbon

[18] - Also known as 'Net Zero'.

budget, as if they fail to do so, the United Kingdom will have to reduce its greenhouse gas emissions by 43 per cent in twenty years, which is more than the United Kingdom has been able to do in the past thirty years. However, it is known that the CCC will be releasing its sixth carbon budget targets for the period 2033 to 2037, including a set reduction target by 2035, in December 2020 (CCC, 2020).

Table 2.2 – United Kingdom's Carbon Budget Targets

Budget	Year	Per cent reduction
1st Carbon Budget	2008 – 2012	23%
2nd Carbon Budget	2013 – 2017	29%
3rd Carbon Budget	2018 – 2022	35% by 2020
4th Carbon Budget	2023 – 2027	50% by 2025
5th Carbon Budget	2028 – 2032	57% by 2030

Source: Adapted from CCC, 2015

In addition to these policies that headline legislation, and which is specifically referred to be committing the United Kingdom to cutting greenhouse gas emissions, there has also been other legislation that had the partial purpose of combatting climate change. These are explored in the following four sub-sections including evaluation of the successes and failures of these policies.

2.2.3.1. Fuel Duty

Hydrocarbon oil duty, commonly known as fuel duty, is a fuel tax which is levied on fuel which has a carbon origin (*Hydrocarbon Oil Duties Act 1979, c.5*). Fuel duty was first introduced in 1909 with the passing of the 'Financial Act 1908' (Mackett *et al.*, 2013). The current rates within the United Kingdom have been the same since 23rd March 2011 and are demonstrated in Table 2.3. It should be noted that all fuel duty prices shown in Table 2.3, do not include the 20 per cent value-added tax [VAT]. For example, £1.10 per litre of petrol would result in £0.76 per litre or 69 per cent of the price at the petrol station goes to the government. The percentage of taxation varies depending on the price of oil; as the cheaper the fuel prices, the greater percentage of the price of fuel that goes to the government in the form of taxation.

Table 2.3 – Current Fuel Duty Rates within the United Kingdom as of October 2020

Fuel	Rate	
Petrol, Diesel, Biodiesel and Bioethanol	£0.5795	Per litre
Liquefied Petroleum Gas (LPG)	£0.3161	Per Kg

Natural Gas (e.g. Biogas)	£0.2470	Per Kg
'Fuel Oil' [For Furnace or Heating]	£0.1070	Per litre

Source: (UK Government, No Date a)

In 1993, under the Conservative Government, the then Chancellor of the Exchequer Norman Lamont, introduced the 'road fuel escalator', also known as the 'fuel price escalator' (Seely, 2011). The initial rate of the fuel price escalator was set at three per cent plus inflation, but was raised later in the year to five per cent plus inflation. There were a number of reasons why the fuel price escalator was increased, but the one was as a technique for the United Kingdom to meet its carbon dioxide targets set at the 1992 United Nations Conference on Environment and Development[19] (AA, 2008).

The aim of the road fuel escalator was to force manufacturers to make more fuel-efficient vehicles and discourage the public in making unnecessary purchases (Gray *et al.*, 2001). It is estimated that the fuel price escalator did have a positive impact for the environment. Firstly, it was estimated by the OECD (2001) that the escalator helped reduce between 2 and 5 million tonnes of carbon dioxide, which roughly reduced the United Kingdom's greenhouse gas emission by between 4.6 to 11.5 per cent based on 1990 levels. This reduction in emissions was in part due to the improved efficiency of vehicles, especially articulated lorries. It is estimated by DETR (1999) that between 1993 and 1998, articulated lorries improved their duel efficiency by roughly 13 per cent. Despite this, it is estimated that 90 per cent of transport emissions are still accountable to road transport. This includes personal vehicles, bus/coaches and articulated lorries (Green Fiscal Commission, 2010).

However, the substantial increase in fuel duty in a short period of time resulted in a growing discontent amongst the public, especially lorry drivers. This lead to the mass fuel protest in September 2000, as fuel within the United Kingdom went from being one of the cheapest within Europe to being the most expensive, and that at the time 72.3 per cent of fuel was taxed (BBC, 2000a). Because of this protest, which lasted a week, the then Labour Government decided to freeze fuel duty until 2002 (Elliot and White, 2000), and between 2000 and 2007, there was only two rises in fuel duty, which were in line with inflation (Green Fiscal Commission, 2010). Between April and June 2017, the price of fuel within the United Kingdom has been £1.14 per litre, which is the 13th most expensive within the European Union. As demonstrated in Figure 2.4 and Appendix K, the price of fuel in significantly more expensive in Scandinavia and Netherlands as within the United Kingdom, especially Norway, which is £0.30 per litre more expensive. This is despite the sharp drop in the pound following the European Union referendum in 2016, which resulted in the price of importing of goods into the United Kingdom,

[19] - The summit has informally also being known as the 1992 Rio Summit and the Earth Summit

including oil, becoming more expensive. Nonetheless, the price of fuel within the European Union is much more expansive compared to countries, such as the United States, Canada and Japan, where the price of fuel is £0.52, £0.71 and £0.87 respectively (Bloomberg, 2017). These variations could be due to reasons such as corporation profits and price of delivery. However, the likely overriding reason for the variation in prices is the amount of tax on the fuel.

As demonstrated, fuel duty within the United Kingdom has previously proven to be successful in reducing emissions, but is highly unpopular. As the fuel prices within the United Kingdom in recent years have not risen as fast as the rest of Europe, it is important to gauge whether the public would support an increase fuel duty soon. But it is known that in 2018 France tried to introduce a similar scheme when the fuel escalator was introduced through their carbon tax component within the fuel tax (Douenne and Fabre, 2020). Consequently, like the United Kingdom, it resulted in large-scale protests, also known a *Gilets Jaunes* protests, leading to the scrapping of future taxes on fuel in December 2018 (Willsher, 2018).

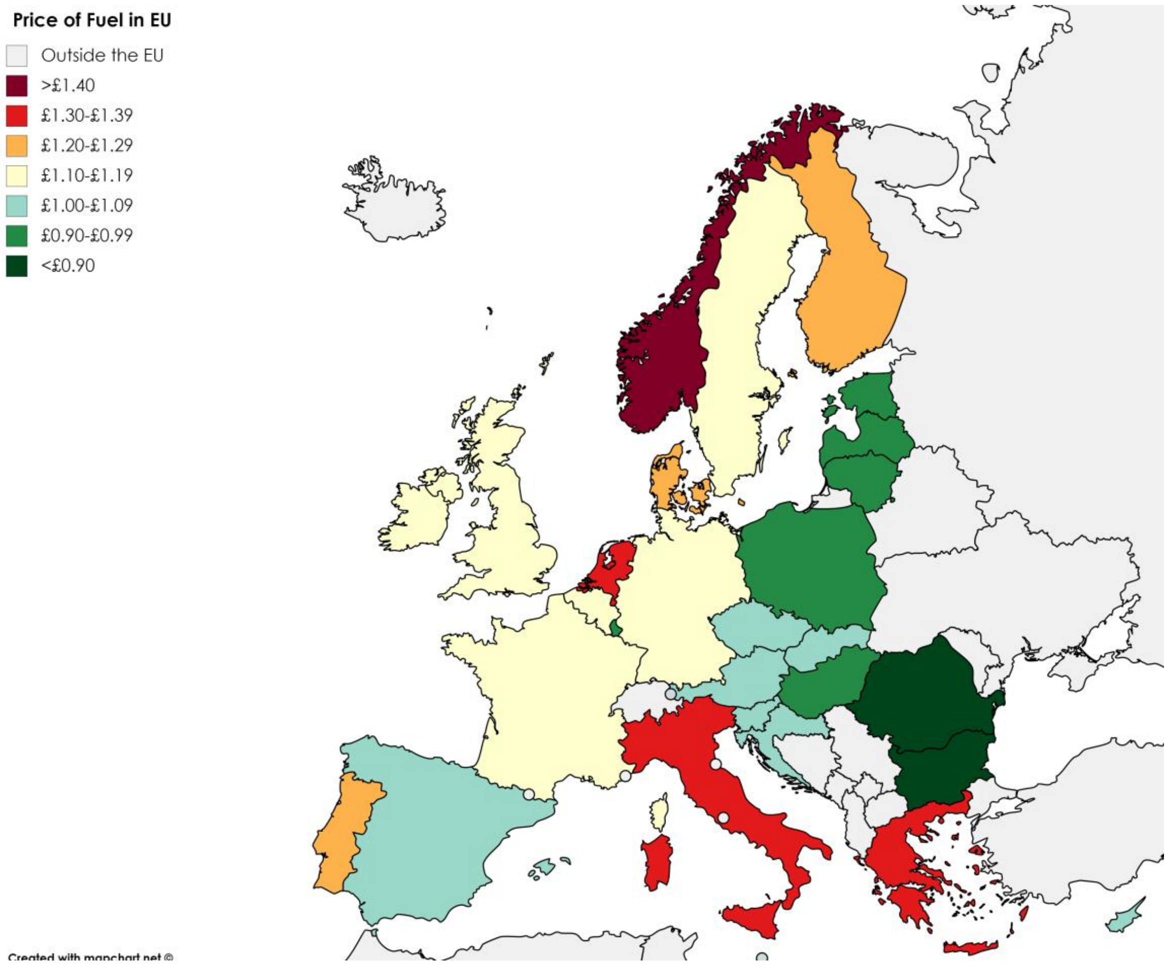


Figure 2.4 – The price of fuel within the European Union between April and June 2017 (Adapted from Bloomberg, 2017). See Appendix K for Full Details for Each Countries Price of Fuel.

2.2.3.2. Climate Change Levy

In 2001, the Climate Change Levy was introduced under the Finance Act 2000. This scheme was the replacement of the Fossil Fuel Levy (Bowen and Rydge, 2011). The purpose of the scheme is to tax energy that is delivered to non-domestic customers within the whole of the United Kingdom. The overarching aim of the scheme is to provide business an incentive to improve energy efficiency, which will reduce carbon emission from lower electricity usage. The government's forecast was that the scheme will reduce annual carbon emission by 2.5 million tonnes by 2010. It should be noted that energy that is derived from nuclear is not exempt from the scheme, despite it producing virtually no carbon emissions. Therefore, only renewable energy schemes, such as solar and wind, were exempt from the scheme. However, in July 2015, the Government announced that this exemption would be removed from the 1st August 2015 (Ofgem, No Date). This removal of the exemption was highly criticised by environmental groups, who stated that it would remove incentives to invest in renewable energies (Macalister and Vaughan, 2015).

2.2.3.3. Vehicle Excise Duty

Another method to reduce carbon emissions from road transport has been vehicle tax[20]. There has been some sort of vehicle tax within the United Kingdom since 1903 and between 1946 and 1999 it was a flat rate. In 1999, a two-tier system was created, depending on the size of the engine[21] (Leicester, 2006). It could be argued that the introduction of this two-tier system was a first attempt to influence the public towards more environmentally friendly cars. Small engine sizes produce fewer emissions as they burn less fuel. Currently, within the United Kingdom, vehicle tax rates depend on the carbon dioxide emissions each produce after its introduction in 2001 (Leicester, 2006). Throughout the time, the vehicle tax rates for high emitting vehicles have been steadily increasing. This was especially so since April 2017, as the regulations were changed to a thirteen-tier sliding system

[20] - Officially known as the Vehicle Excise Duty (VED) within the United Kingdom, but is sometimes called road tax.

[21] - The two tiers were below and above 1,100cc engines.

depending on the amount of carbon dioxide emissions per kilometre for the first year and then a fixed amounts depending on the fuel type (UK Government, No Date b).

In a study by Lancaster (2006), it was found that the average greenhouse gas emissions from new cars dropped from 189.8 g CO_2/km in 1997 to 169.4 g CO_2/km in 2005; which represents an emissions reduction of 10.75 per cent during the eight year period. This demonstrates that the combination of this tax and fuel duty, discussed in the previous sub-section, has resulted in manufacturers having to produce more environmentally friendly cars, as the cost of running cars was increased in this period.

2.2.3.4. Green Deal Scheme

During the Conservative-Liberal Democratic coalition of 2010 to 2015, the Government focused on improving the energy efficacy of homes to reduce greenhouse gas emissions. This led to the introduction of the Green Deal Scheme. Green Deal was a policy in which the government give loans to homeowners to make energy efficacy improvements to their homes, with the loans being repaid back through the saving on their energy bills. The scheme came into force in January 2013. However, the scheme was considered a failure (Carter and Clements, 2015). This was demonstrated within the press, which reported that within the first six months of the scheme, 38,259 Green Deal assessments had taken place, but only four households had signed up to the Green Deal loan (Gray, 2013). In terms of engaging with the public about climate change, the free assessment showed that the public were engaging with the issue. But one major reason for its failure was financial due to the high interest rates on the Green Deal loans; the interest rate was eight per cent, which was nearly double of some mortgage rates at the time (Lonsdale, 2014; TGDFC, 2013). As a result, the scheme was cancelled in July 2015 (Vaughan, 2015).

2.2.4. Policy – Northern Ireland

In 2013, it was reported that Northern Ireland's greenhouse emissions were only 4 per cent of the United Kingdom's greenhouse gas emissions (CCC, 2015c). Whilst it represents a small amount of the overall greenhouse emissions in relation to the United Kingdom, when compared to factors such as population and gross domestic product (GDP), which are 2.8 per cent and 2.1 per cent respectively, it is demonstrate that Northern Ireland is proportionally emitting significantly more than the rest of the United Kingdom. As demonstrated within Figure 2.5, the majority of emissions within the Northern Ireland are from agriculture whilst in the rest of the United Kingdom it is from power supply.

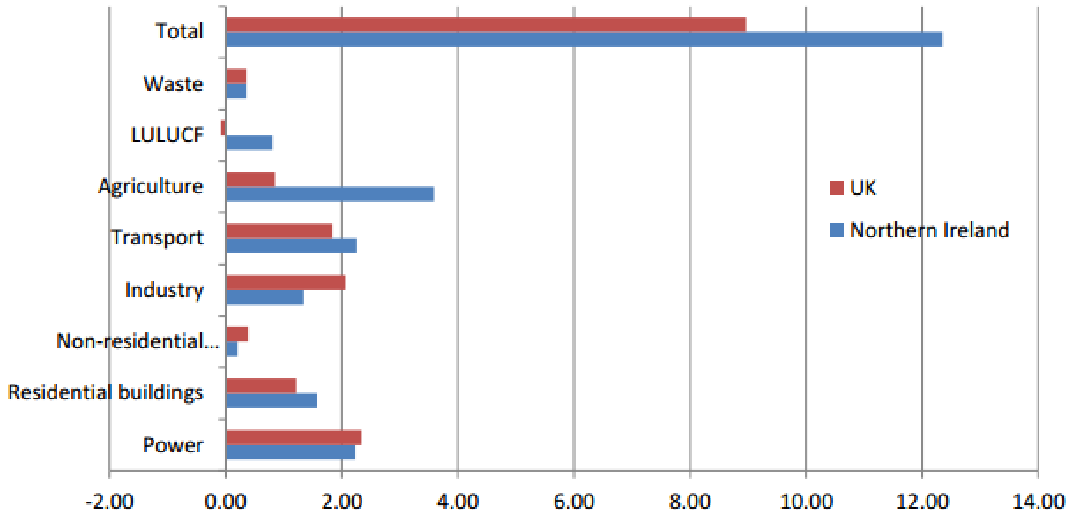


Figure 2.5 – Total and sectoral emissions (tCO_2e) per capita in both Northern Ireland [Blue] and the United Kingdom [Red] in 2013 (CCC, 2016)

Despite this, it estimated that Northern Ireland has reduced its greenhouse gas emissions by 20.2 per cent compared to 1990 levels, as demonstrated in Figure 2.6 and Appendix L. But this compares with the rest of the United Kingdom having reduced their greenhouse gas emissions by a 30 per cent in the same period (CCC, 2016).

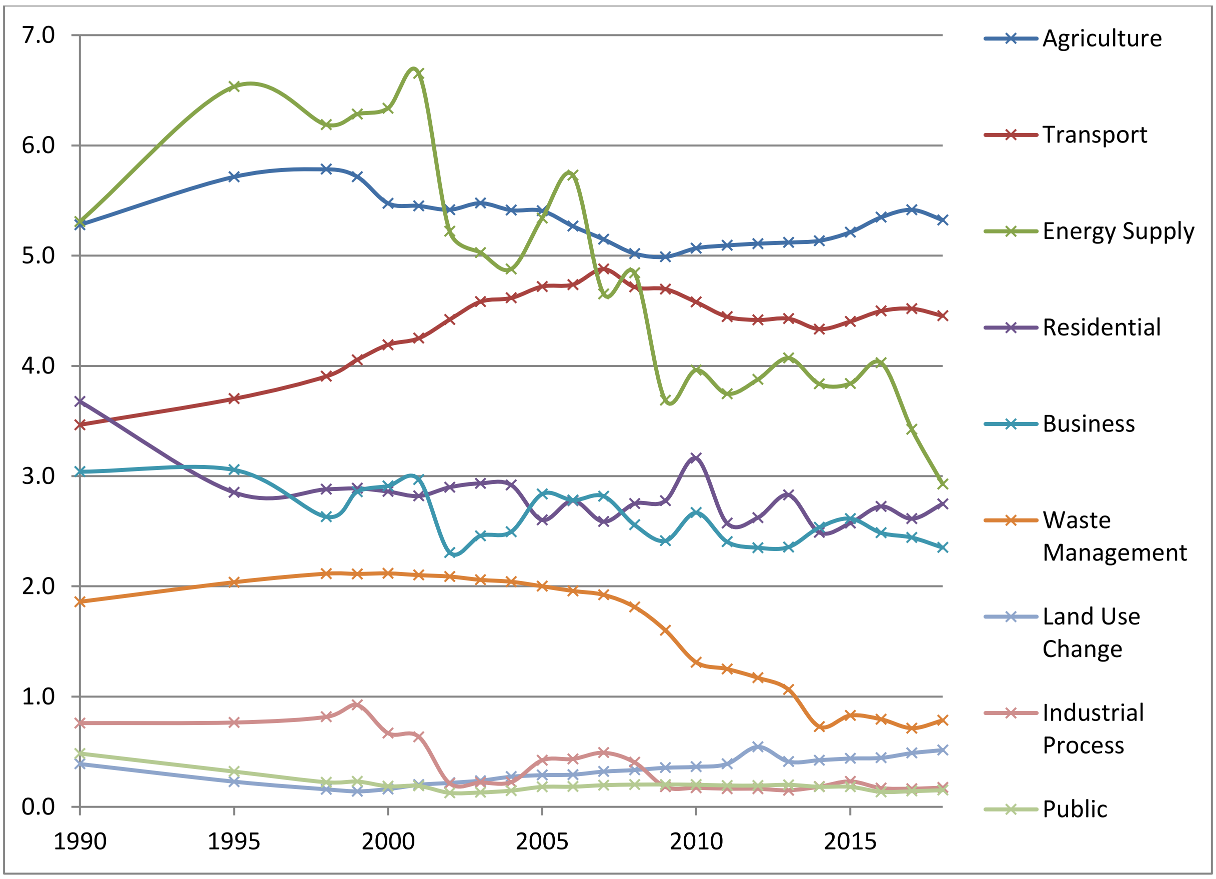


Figure 2.6 – Northern Ireland's greenhouse gas emissions (KtCO$_2$e) by sector in 1990, 1995 and between 1998 and 2018 (Source: Data Adapted from DAERA, 2020). See Appendix L for Full Breakdown of Greenhouse Gas Emissions.

The Northern Ireland Executive highlighted its target to reduce greenhouse gas emissions by at minimum of 35 per cent by 2025 within its Programme for Government (2011-2015) (NIGOV, 2010). This is lower share of reduction compared to the rest of the United Kingdom. However, as highlighted by the CCC (2016), Northern Ireland has the highest share of agriculture, which is the hardest sector to reduce greenhouse gas emissions, due to the large methane produced from pastoral farming (Palmer, 2009; Pinares-Patiño *et al.*, 2009).

One of the most ongoing concerns about Northern Ireland's progress in reducing its greenhouse gas emissions is that they do not have any long term legislation passed by Stormont, the national assembly, to cut emissions, which the rest of the country do; and is likely to take a while to pass any new legislation as Stormont only sat for the first time in three years at the beginning of 2020. In addition, as a consequence of the COVID-19 pandemic impact on Northern Ireland, the national assembly have put had large amount of their focus on the management of the spread of COVID-19 and the medium-term economic recovery package.

2.2.5. Policy – Scotland

In the late 1990s and early 2000s, there was momentum within Scotland for greater independence from the United Kingdom. This led to the Scotland Act 1998, which was amended in both 2012 and 2016. This act created the Scottish Parliament, which led to the devolution of power. This devolution allowed Scotland to take control from the United Kingdom on some laws which affect Scotland, including Climate Change. It is estimated that Scotland's Greenhouse gas emissions only account for 10 per cent of the United Kingdom's overall emissions (Scottish Government, 2009).

In 2009, the Scottish Government passed the *Climate Change (Scotland) Act 2009*. The overall target is to cut 80 per cent of greenhouse gas emissions by 2050, which is in line of the rest of the United Kingdom under the Climate Change Act 2008. However, the targets of reduction set in the mid-term are much greater than the United Kingdom. The Act states that Scotland must reduce its greenhouse gas emissions by 42 per cent by 2020, based on 1990 levels. This compares to the rest of the United Kingdom which has set a target of 35 per cent. It is worthy to note that Scotland has already exceeded this target, with a 45.4 per cent reduction by 2018, due to the 70 per cent decline from the energy supply sector, as demonstrated in Figure 2.7 and Appendix M.

Also, Part 6 of the Act, sets out how the Scottish Government will increase the public engagement of climate change. This includes publishing a strategy paper on the steps that the government would be undertaking to encourage the public to engage with climate change. This was undertaken in December 2010, through the publishing of the "Low Carbon Scotland – Public Engagement Strategy" report (Scottish Government, 2010).

However, whilst there had been plans to increase the rate of reduction of greenhouse gas emissions in legislation since 2017 (Scottish Government, 2017), it was not until October 2019 that this was realised with the *Climate Change (Emissions Reduction Targets) (Scotland) Act 2019.* This Act partly replaces the *Climate Change (Scotland) Act 2009* and includes that Scottish emissions will be net zero by 2045, instead of the 2050 being set at the national level. In addition to this, ten year interim targets have been set to help the transition to a low carbon state. These include cutting greenhouse gas emissions by 56, 75 and 90 per cent by 2020, 2030 and 2040 respectively.

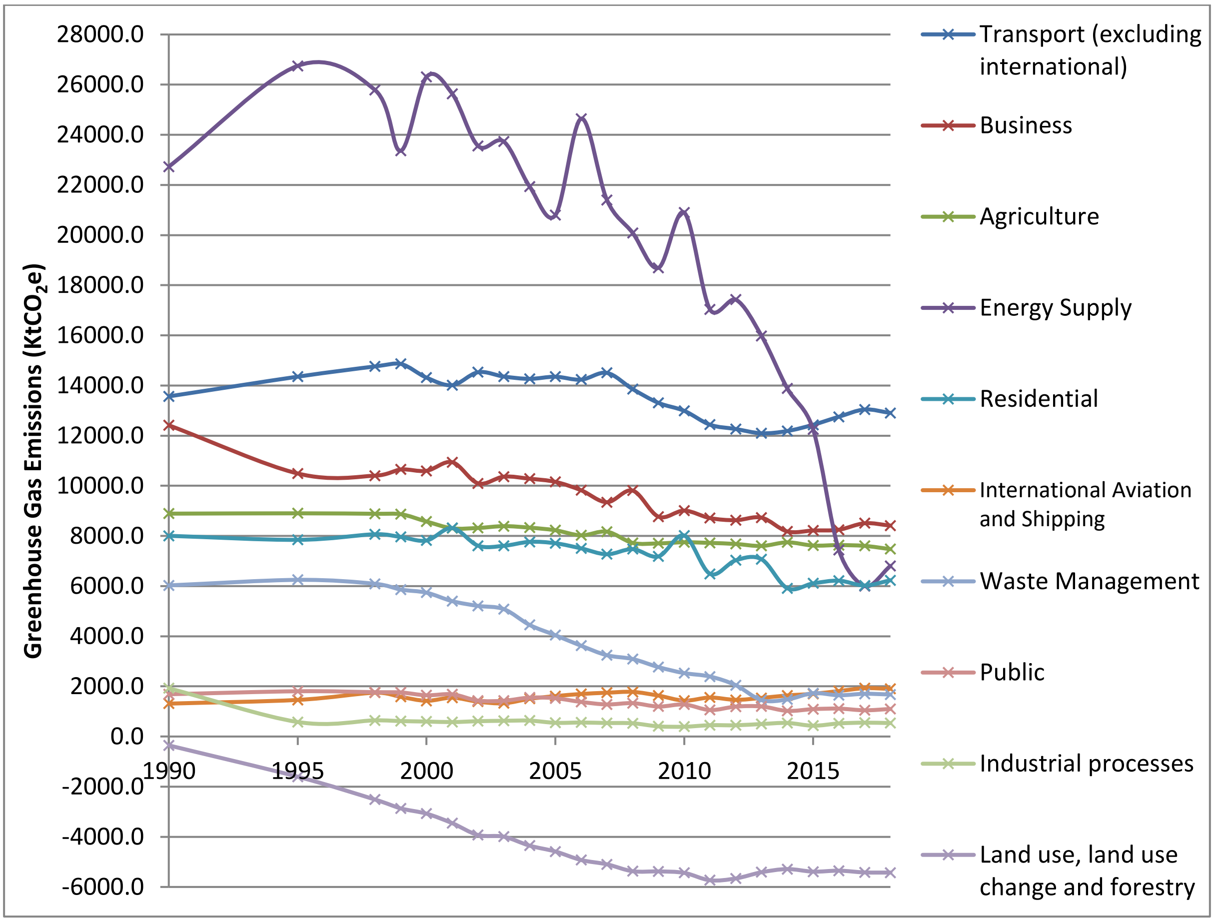


Figure 2.7 – Scotland's greenhouse gas emissions ($MtCO_2e$) by sector in 1990, 1995 and between 1998 and 2018 (Source: Data Adapted from Scottish Government, 2020). See Appendix M for Full Breakdown of Greenhouse Gas Emissions.

2.2.6. Policy – Wales

In 2016, Wales passed the Environment (Wales) Act, which states that Wales needs to reduce its greenhouse gas emissions by 80 per cent by 2050; which is the same target as for the rest of the United Kingdom. In addition, Wales will be setting interim targets for 2020, 2030 and 2040.

In nearly 30 years, there has been an overall downward trend in the amount of greenhouse gases that Wales has been emitting. This has been observed by DECC (2014) which highlights that between 2005 and 2012, there has been a nineteen per cent decline in the annual emissions of carbon dioxide within Wales. However, it should be noted that between 1990 and 2014, there has been only an eighteen per cent decline in greenhouse gas emissions (CCC, 2017). This can be attributed to a sudden rise in the emissions of the early 1990's, due to the closure of Transfynydd nuclear power station in 1991, which were replaced with gas-fired power stations (CCC, 2017).

In addition to the targets set by the United Kingdom, Wales in 2010 set a three per cent target reduction per year in carbon dioxide emissions (Welsh Government, 2010). This is demonstrated in Table 2.4. In addition, Wales set out a 40 per cent greenhouse gas reduction target by 2020, based on 1990 levels (Welsh Government, 2010). It should be noted that the three per cent reduction is based on projected emission results from 2010, which was estimated to be 34.03 $MtCO_2e$. However, in 2010 there was a drastic rise in the amount of carbon dioxide produced in Wales, and the overall figure of 39.1 $MtCO_2e$ (Thomas and Kluiters, 2012). This equates to nearly 5 $MtCO_2e$ or 14.9 per cent increase on project emissions rate. This has been attributed to two extreme cold snaps during 2010 (Hughes, 2012; Thomas and Kluiters, 2012). In addition to this, Wales's greenhouse gas emissions increased by ten per cent. This was attributed to cold winter weather, increased industrial production and increased coal production (CCC, No Date).

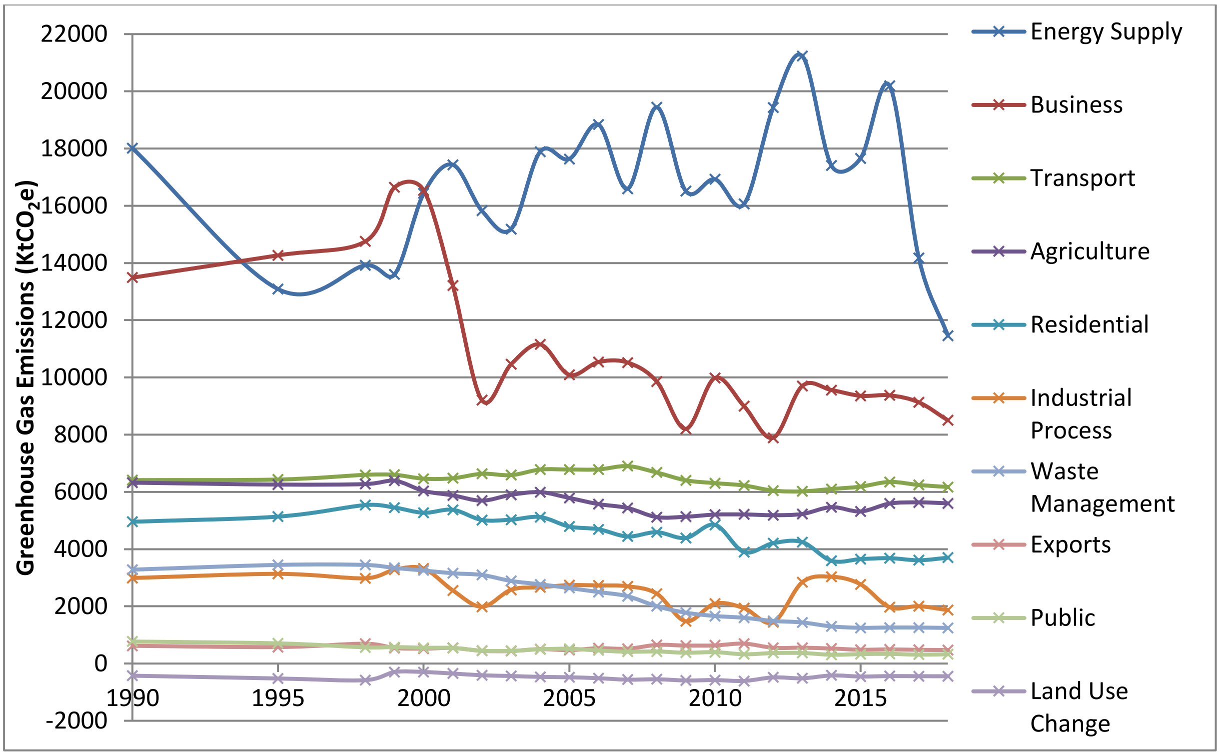
Table 2.4 – Emission saving targets for Wales between 2011-2012 and 2019-2020

Year	**% saving**	**Emissions saving ($MtCO_2e$)**	**Emissions trajectory based on current baseline of 34.03 $MtCO_2e$**

2011-2012	3	1.02	33.01
2012-2013	6	2.04	31.99
2013-2014	9	3.06	30.97
2014-2015	12	4.08	29.95
2015-2016	15	5.10	28.93
2016-2017	18	6.13	27.91
2017-2018	21	7.15	26.88
2018-2019	24	8.17	25.86
2019-2020	27	9.19	24.84

Source: Welsh Government, 2010

As highlighted earlier, Wales by 2014 had decreased its greenhouse gas emissions by roughly 18 per cent. Since then, Wales has observed an increasing rate of decline in its greenhouse gas emission, with this reduction levels in 2018, were at 31.1 per cent[22]. As observed within Figure 2.8, the main reason for this decline in emissions is due to the reduction in the emissions from the energy supply, with similar trends being observed across the United Kingdom.



[22] - Full figures of Wales's greenhouse gas emission are available in Appendix N.

Figure 2.8 – Wales's greenhouse gas emissions (KtCO$_2$e) by sector in 1990, 1995 and between 1998 and 2018 (Source: Data Adapted from StatsWales, 2020). See Appendix N for Full Breakdown of Greenhouse Gas Emissions.

2.2.7. Policy – Crown Dependencies

The Crown dependencies are self-governed states that traditionally do not form part of the United Kingdom or the British Oversea Territories. Each of the Crown Dependencies has control of their own laws, and International and British laws can only be enforced with the consent of the Island's parliaments (UK Parliament, 2010). However, at the international level, the Crown dependencies are recognised as territories of the United Kingdom, rather than been classified as a sovereign nation (Justice Committee, 2014). This is because of Article 29 of the Vienna Convention on the Law of Treaties, which was adopted in 1969, states that "unless a different intention appears from the treaty or is otherwise established, a treaty is binding upon each party in respect of its entire territory" (UN, 1969, p.11). Despite this, the United Kingdom's pledge to reduce its greenhouse gas emissions to a net zero by 2050 does not include the emissions from the Crown Dependencies (ONS, 2019a).

There are three Crown Dependencies located around the British Isles, which include the Isle of Man, and the Bailiwicks of Guernsey and Jersey. As each has their own parliament, it means that each also have separate laws in relation to climate change. But, in general these islands tend to follow the United Kingdom, as until 2019, each had targets to reduce their greenhouse gas emissions by 80 per cent by 2050.

2.2.8. Levels of Greenhouse Gas Emissions

The previous sections have outlined how there has been a number of policies which have been legislated in the past thirty years to combat climate change.

However, the carbon dioxide emitted each year has continued to rise (Peters *et al.*, 2020), despite all the warnings the scientific community provided; this is demonstrated by Frumhoff, Heede and Oreskes (2015) in Figure 2.9 Showing that the amount of carbon dioxide emitted between 1988 and 2014, is roughly equivalent to that was emitted between 1751 and 1987.

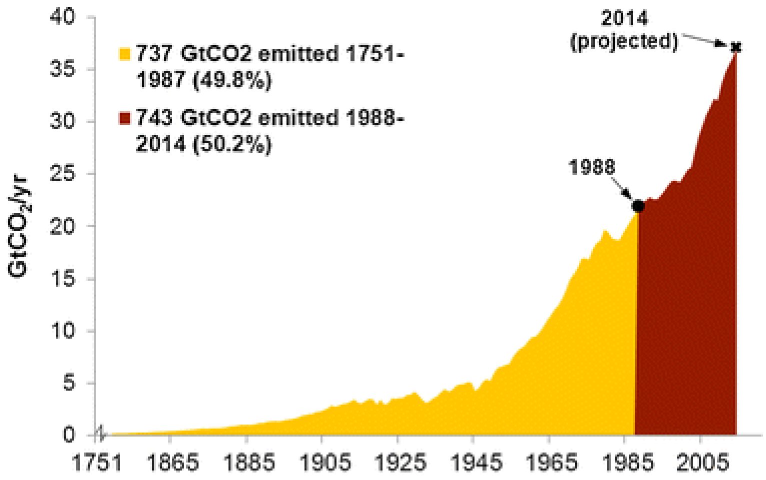
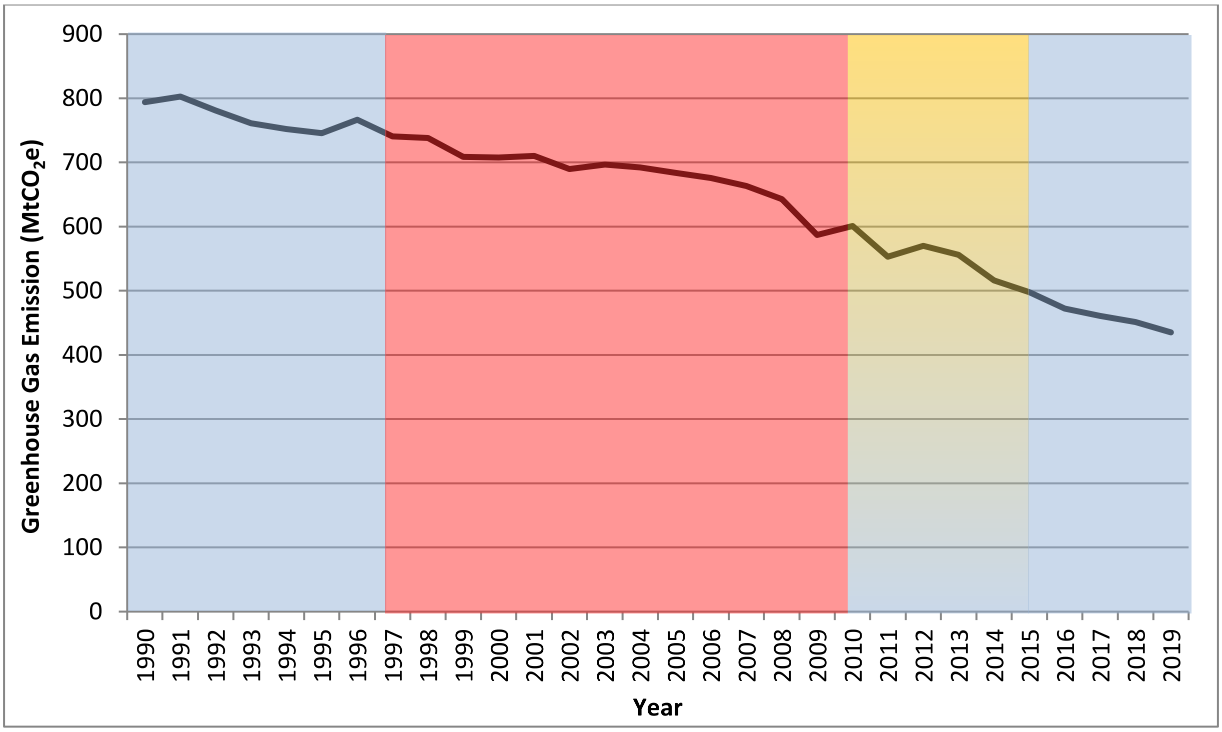


Figure 2.9 – The levels of carbon dioxide being emitted globally each year between 1751 and 2014 (Frumhoff, Heede and Oreskes, 2015, p.164)

As of 2019[23], the United Kingdom has reduced its greenhouse gas emissions by 45.2 per cent [358.6 $MtCO_2e$] and its carbon dioxide emissions by 41.0 per cent, based on 1990 levels. It should be noted that internationally there can be a small variation in the amount of emissions been reported as the United Kingdom is also responsible for the emissions of the UK Overseas Territories[24]. This reduction in greenhouse emissions is demonstrated in Figure 2.10, which shows that 2015 was the first year that greenhouse gas emissions within the United Kingdom dropped below the $500MtCO_2e$ level. It should be noted that this reduction has been achieved at a time when the population of the United Kingdom has been steadily rising, with an estimated population of 57.2 million in 1990 and 66.9 million in 2019 (ONS, 2019b). This meant that whilst the United Kingdom has overall lost 38 per cent of greenhouse gas emissions between 1990 and 2015, it has actually made a 53.1 per cent reduction of greenhouse gas emissions per capita in the same period.

[23] - Based upon provisional greenhouse gas emission for 2019

[24] - The UK Oversea Territories include Anguilla, Ascension Island, Bermuda, British Antarctic Territory, British Indian Ocean Territory, British Virgin Islands, Cayman Islands, Falkland Islands, Gibraltar, Montserrat, Pitcairn Islands, Saint Helena, South Georgia and the South Sandwich Islands, Tristian de Cunha, and Turks and Caicos Islands.



Blue Background = Conservative Government; Red Background = Labour Government; Gold/Blue Background = Conservative-Liberal Democrats Government

Figure 2.10 – The greenhouse gas emissions for the United Kingdom between 1990 and 2019 (Adapted from BEIS, 2020a). Full Breakdown of Greenhouse Gas Emissions within the United Kingdom is available in Appendix O.

It should be noted that greenhouse gas emissions are not equally spread across different sectors as a consequence of varying policies and development of technology. As demonstrated within Figure 2.11, the sector that has observed the most reduction in the past thirty years is the energy supply sector. This can be attributed to sharp reductions in recent years for coal usage in the generation of electricity, from 40 per cent in 2014 to 5 per cent in 2018 (Evans, 2019). Consequently, this has been the largest contributor in the reduction of greenhouse gas emissions within the United Kingdom, with a 62.8 per cent reduction between 1990 and 2019 in the energy sector.

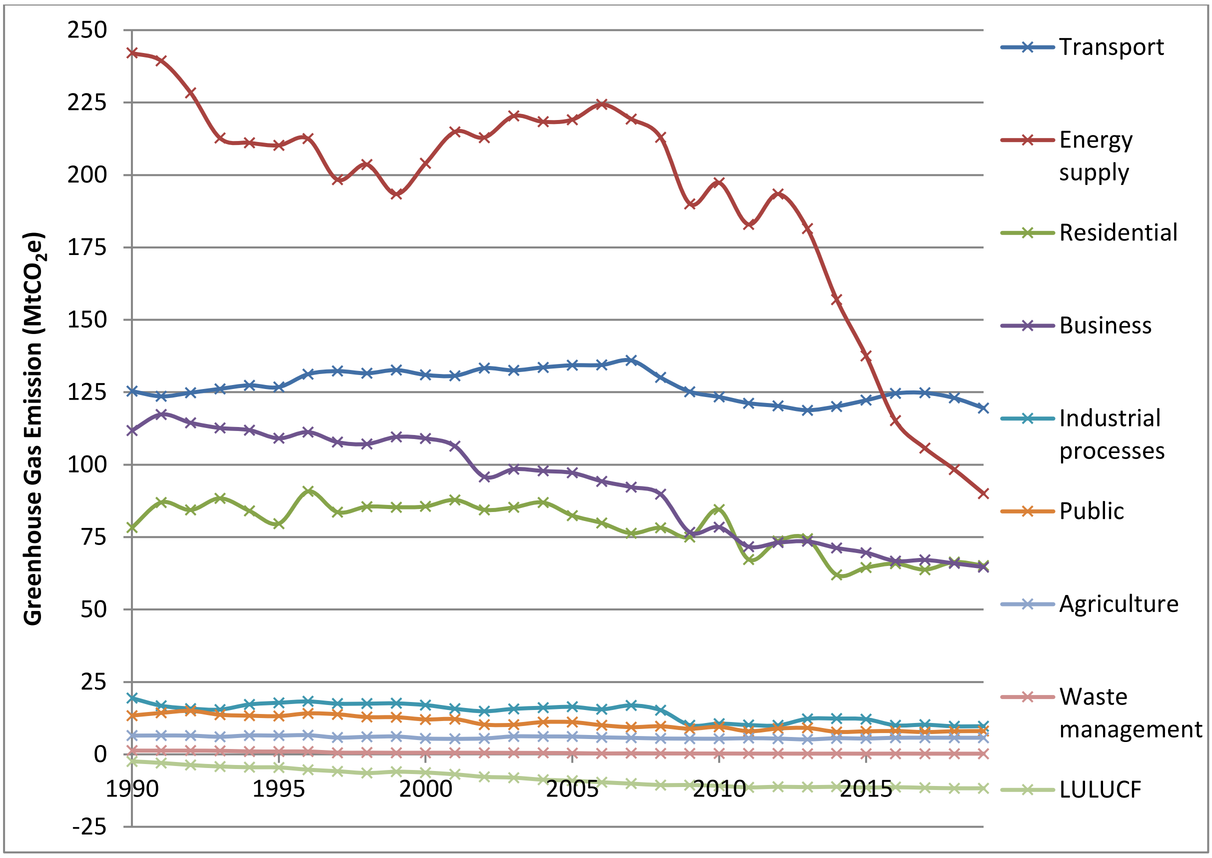


Figure 2.11 – The greenhouse gas emission per sector for the United Kingdom between 1990 and 2015 (Adapted from BEIS, 2020a). See Appendix O for values of each sector year on year.

Lastly, the level of greenhouse gas emission reductions between the different nations that make up the United Kingdom also vary, as demonstrated within Table 2.5.

Table 2.5 – Greenhouse Gas Emission Percentage Reduction in all Four Nations between 1990 and 2018

Nation	Percentage Reduction
England	45.7%
Scotland	45.4%
Wales	31.1%
Northern Ireland	20.2%
United Kingdom	43.1%

See Appendix L, M, N, O and P for full details.

2.2.9. Emission Outsourcing

As demonstrated in the previous sub-sections, in the United Kingdom there is a large amount of legislation in relation to climate change mitigation. As a result, the United Kingdom as a whole has reduced its emissions by 45.2 per cent, based on 1990 emissions (BEIS, 2020a). However, it is debatable whether the United Kingdom has actually reduced its emission by as much as it has claimed. In the last 40 years, the United Kingdom and other developed countries have observed a steady decline of the manufacturing industry (Berry, 2018; Harris and Moffat, 2019), with much of this moving to developing countries, such as China (Li, 2013; Li, 2018) and India (Iyer, 2018). This outsourcing has two major issues that result in high emissions from these industries. Firstly, the vast majority of energy in a number of developing countries, and especially so in China's case, is derived from fossil fuel (China Electricity Council, 2019); principally coming from coal, which is the highest emitting fossil fuel. Secondly, large quantities of energy are needed to transport goods and therefore large quantities of greenhouse gas emissions being emitted, when these same items used to be produced within the United Kingdom. It is currently estimated that carbon dioxide emissions from transporting freight is equivalent to thirty per cent of global transport carbon dioxide emissions, and six per cent of global carbon dioxide emissions (ITF, 2015).

It was found by Yunfeng and Laike (2010) that between 10.03 and 26.54 per cent of all carbon emission emitted by China were related to goods that were manufactured to be consumed outside China, with the vast majority been sold within developed countries. It has been estimated that this form of outsourcing of emissions has increased from 150.18 megatonnes [Mt] of carbon dioxide in 1997 to 593 Mt in 2007. However, these two sets of figures were taken from a decade ago, which means that it is highly probably that these emissions and per cent of emissions will have changed.

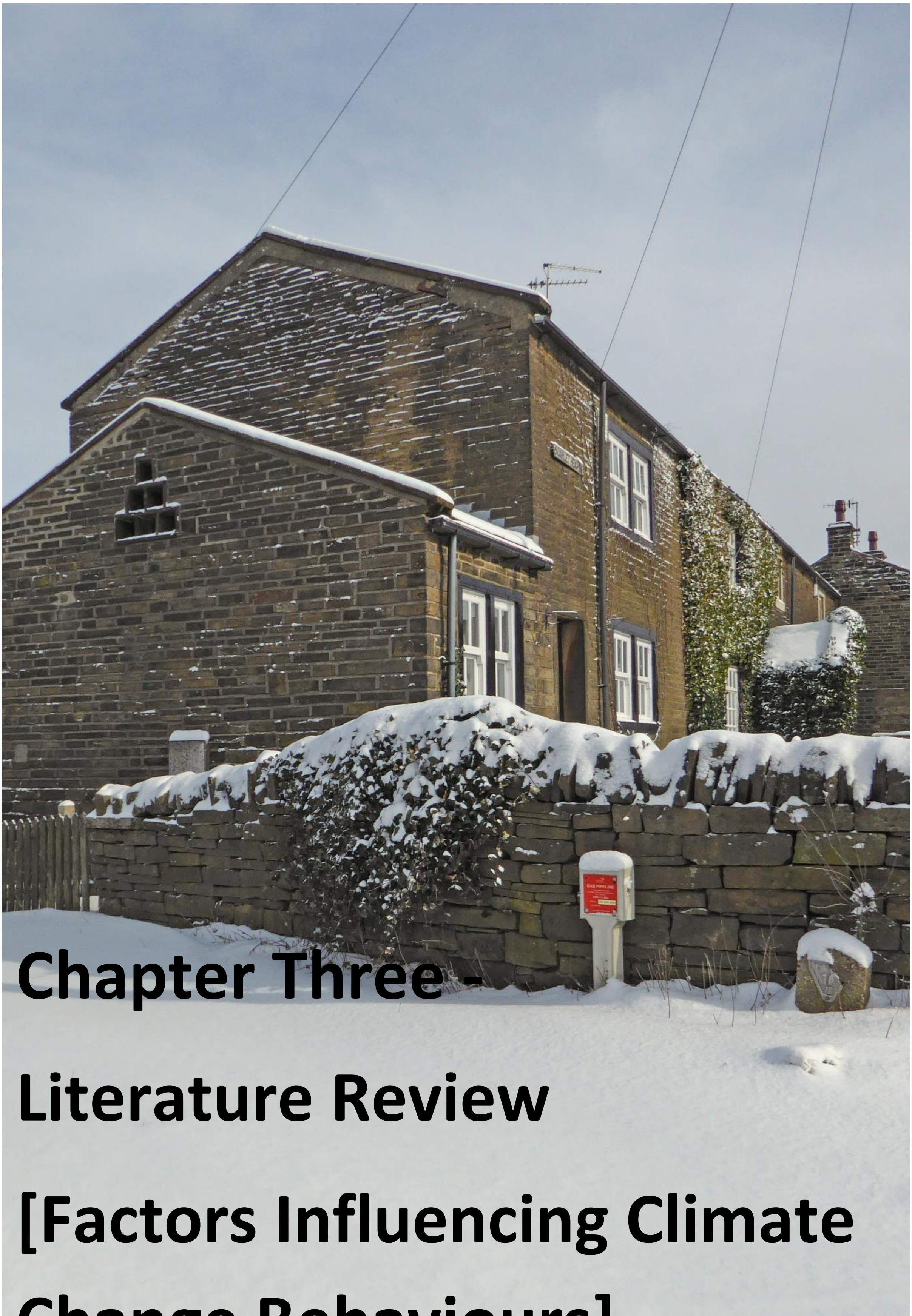
2.2.10. Overview

As demonstrated within this section, the United Kingdom has been at the forefront of combatting climate change since it became recognised as a major environmental issue at the global level over thirty years ago. It shows that the United Kingdom has committed itself to some of the most ambitious greenhouse gas reduction targets in the world. So far, the United Kingdom has observed one of the largest greenhouse gas emission reductions since 1990. This success is not down to one single piece of legislation, it has been combined with a number of smaller pieces of legislation since the mid-1990s. However, it should be noted that the overall success of future reductions will be difficult. Whilst there is support for action on climate change[25], some of this will be unpopular and could see the public resist, such as in relation to the fuel price escalator that was scrapped in September 2000.

Lastly, whilst the devolution of the issue of climate change to national assemblies and parliaments within the United Kingdom has seen Scotland pulling ahead in reducing its greenhouse gas emissions, there are risks that other parts of the United Kingdom, especially Northern Ireland are falling further behind. Already, it is the only part of the country not to have legislation or national plans to combat climate change, and this is unlikely to be achieved due to Northern Ireland having only just reopened its parliament after three years, and therefore it will focus on perceived more pressing issues.

What is clear in the United Kingdom is that without the public in support and/or demanding for action in relation to climate change action, no legislation is likely to be passed. Therefore, it is important to engage in research that seeks to understand what United Kingdom resident people think about and do about climate change.

[25] - See Section 3.1 for further details on this level of support for action on climate change



Chapter Three - Literature Review [Factors Influencing Climate Change Behaviours]

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3.1. Public Perception and Comprehension of Climate Change

The previous chapter addressed the science of climate change and what has been undertaken both at the international and national scale to mitigate against the worst potential impacts of climate change. The science is becoming increasingly certain and sluggish action is been taken against reducing greenhouse gas emission globally. It is important to note that without the support of the public, action and progress will further dawdle and opportunities to avoid climate tipping points will be missed. Research has highlighted public support and attitude towards climate change as important for policymakers to legislate against the issue (Stotenborogh and Vedlitz, 2012 cited in Stoutenborough, Liu and Vedlitz, 2014). In the past thirty years, extensive research has been undertaken in Australia, Europe and the United States about civil societal perception of climate change (Lorenzoni and Pidgeon, 2006; Whitmarsh, 2011; Brulle, Carmichael and Jenkins, 2012; Lee et al., 2015). This is key to understanding public action.

Research on climate change perception and comprehension amongst the public within the United Kingdom has been undertaken for at least two decades using a myriad of different research techniques. For quantitative questionnaire approaches, there is a regular government's 'BEIS Public Attitudes Tracker' survey[26], which are carried out by the Department for Business, Energy and Industrial Strategies every three months including questions about climate change being asked every March (BEIS, 2019). In addition, to these surveys, academic surveys have been conducted by Dessai and Sims (2010), Larcom, She and van Gevelt (2019), and Whitmarsh, Xenias and Jones (2019). Also, opinion pollsters have been conducting surveys about climate change as well, for example Ipsos MORI and YouGov. An extensive array of studies that have been undertaken to gather the public's perception and comprehension on climate change within the United Kingdom are listed in Appendix A.

The most researched country in relation to public perception of climate change is the United States, with a number of qualitative (Rohling *et al.*, 2016; Whitmarsh, Xenias and Jones, 2019) and quantitative studies (Dunlap, McCright and Yarosh, 2016; Bohr, 2017; Ballew *et al.*, 2019; Ballew *et al.*, 2020; Gustafson *et al.*, 2020a).

[26] - Previously known as the 'Public Attitudes Tracker: Energy and Climate Change' before August 2018

3.1.1. Awareness of Climate Change

Extensive research has been undertaken both within the United Kingdom and internationally, which demonstrates that there is widespread awareness of climate change (Norton and Leaman, 2004; Pelham, 2009). However, this awareness of climate change is unequally distributed internationally, with people from Europe, Japan and North America being the most likely to be aware of climate change and Japan being the most aware at 98.9 per cent (Lee *et al.*, 2015). The United Kingdom respondents were overall the fifth most aware (97.4 per cent).

3.1.2. Comprehension of the Cause of Climate Change

There is acceptance amongst the British that climate change is occurring, a recent study indicating that 94 per cent say climate change is occurring (BEIS, 2019), with the majority of these believing it is due to anthropogenic activity (BEIS, 2019); this finding is similar to past studies, but to varying extents (Poortinga et al., 2011; Poortinga, Aoyagi and Pidgeon, 2013). Overall, using the BEIS survey for the 2010s, the lowest point in the acceptance of climate change was in March 2013 at 92 per cent; whilst, the highest point was in March 2016 at 96 per cent (BEIS, 2019).

One of the issues for society is the complexity of climate change; as a consequence, research has demonstrated that the public can confuse climate change with other environmental risks. The most common commingle is in relation to ozone depletion and how that can cause climate change. It is worth noting that there is a small relationship between depletion of the ozone and climate, but it should have a negative impact on temperatures (DEFRA, No Date). Within the United Kingdom, it was found that 19.9 per cent of respondents to surveys believed that the depletion of the ozone layer was causing climate change (Whitmarsh, 2009), with similar results been observed by Poortinga, Pidgeon and Lorenzoni (2006). In addition, Whitmarsh (2009) found that 25.3 per cent of respondents consider ozone depletion to be a cause of global warming; this compares to 13.7 per cent who indicated it to be due to climate change. However, these figures are down from those of DEFRA (2002), which show 70 per cent of English respondents believed that ozone depletion is a cause of climate change.

This is not an interpretation that is confined to the United Kingdom, with past studies finding a similar confusion internationally, including in the United States, Canada, Japan, Brazil, Indonesia and Singapore, amongst civil society (Bostrom *et al.*, 1994; Dunlap, 1998; Brechin, 2003; Hargreaves, Lewis and Speers, 2003; Leiserowitz, 2006; Lorenzoni and Pidgeon, 2006; Gifford and Comeau, 2011; Ahsan and Brandt, 2015) and amongst students (Boyes and Stanisstreet, 1994; Rye, Rubba and Wiesenmayer, 1997; Österlind, 2005; Chang and Pascua, 2016). Research suggests that this confusion originates from both climate change and ozone pollution being an atmospheric environmental issue (Read *et al.*, 1994; Hargreaves, Lewis and Speers, 2003).

3.1.3. Concern about Climate Change

In the last thirty years, climate change has become an increasing concern within civil society. Within the latest Eurobarometer that focused on climate change in 2019, 75 per cent of the British ranked climate change as a very serious problem, which is 13 per cent greater compared to 2017. When compared to the European Union in general, the United Kingdom is ranked below average, which is 79 per cent (Eurobarometer, 2019a). Despite this, the public's concern of climate change in relation to health, security and social issues is increasing, but is still behind immigration at the European Union level (Eurobarometer, 2019b).

Further to this Brechin (2010) demonstrates that 52 per cent of the public believed that global warming is a 'less serious' problem, with 45 per cent saying it was a 'very serious' problem. This demonstrates that marginally more people believed climate change is a serious issue. These figures compare to the United States, which shows that 50 per cent of the public believe that global warming is a 'less serious' problem; and 47 per cent it was 'very serious' problem. This demonstrates that previously, there was more concern about climate change within the United States compared to the United Kingdom.

3.1.4. Scepticism of Anthropogenic Climate Change

There are some who are sceptical whether the current climate change is caused by anthropogenic activities (Bostrom *et al.*, 1994; Gelbspan, 1998; Fortner *et al.*, 2000; Anderegg *et al.*, 2010). Section 3.3 provides further details about what drives scepticism about anthropogenic climate change. BEIS (2019) found that between 2014 and 2019, the proportion of the public who believe the climate change is caused by natural processes has declined, from 13 per cent to seven per cent. In addition, it was found that in the 2019 study, only two per cent of the respondents did not believe there was change in the current climate; and three per cent did not know. This contrasts to the United States where the proportion of respondents that do not believe in [or do not know about] anthropogenic climate change is 41 per cent (Leiserowitz *et al.*, 2019a); which equates to a difference of 29 per cent between the two nations. In addition, 12 per cent of American's do not believe that climate change is occurring (Leiserowitz *et al.*, 2019a), which is a 10 per cent difference. This demonstrates that the

United Kingdom is much less sceptical about anthropogenic climate change compared to other western countries.

It was also found within the BEIS (2019b) that the proportion of 16 to 24 year olds that believed in anthropogenic activity causing climate change is 61 per cent, which compares to the population average of 48 per cent.

As explored in Section 3.3 and 3.5, the scepticism being observed within both the United Kingdom and United States is likely to be a result of the media presentation of climate change. In addition to this, climate change can be viewed as a slow-onset disaster, as people are not able to see the visual changes to climate and environment around them from one day to the next, as it takes years, if not decades for the changes to be felt.

3.1.5. Environmental Taxation

Environmental taxation has two distinctive aims; firstly it is to raise revenue which is raised to fund 'greener' infrastructure (EEA, 2000). The second is as a way to influence the behaviour of civil society and businesses to protect the environment (McEldowney and Salter, 2015).

Environmental taxation has occurred within the United Kingdom since 1993 with the introduction of the 'road fuel escalator'; since then, there has been plenty of legislation that has aimed to influence behaviour in society to become more environmentally friendly. However, it is argued that these are regressive taxes (Leicester, 2006). This means, that the poorest in society, who generally already emit less than more affluent counterparts, are being taxed a greater proportion of their income. As a consequence, as observed in the United Kingdom and France, these measures have resulted in mass protests due to the rising costs outstripping wage increases (BBC, 2000a; Elliot and White, 2000; Tapiero, Robinson and Smith-Spark, 2018; Douenne and Fabre, 2020). This is presumed to also influence public comprehension about the criticality of climate change.

3.1.6. Overview

The findings within this section suggest that there is a difference between society's perception and comprehension of climate change compared to that of climate scientists. These differences could be due to varying factors, some of which have been introduced. These relationships are explored further in chapter five of this thesis, as findings resulting from methodologies in line with the application of inter-disciplinary research involving public perception of a set issue.

3.2. Factors Influencing Perception about Climate Change

It is believed that perceptions of climate change are easily influenced (Li, Johnson and Zaval, 2011). The following sub-sections will explore potential factors that the literature has highlighted previously might be influencing climate change perception.

3.2.1. World View

The term world view comes from the German word *'Weltanschauug',* which is translated as either 'worldview' or 'world outlook' (Marshall, Griffioen and Mouw, 1989). Ibrahim and Kahn (1987, p. 164) refer to "beliefs, values and assumptions, derived from the socialization process in a specific cultural context". This highlights that beliefs are subjected to the process and interactions that an individual has with people and the environment around them. This is why Kraft (2008) highlights that worldviews can be changed but rarely replaced, as the worldviews are viewed as the fundamental core beliefs of individual processes.

The following three sub-sections will explore different world view factors that might affect an individual's perception and/or comprehension of climate change.

3.2.1.1. Political Identity

The most politically divided country in terms of perception of environmental issues, including climate change, is the United States, but this has not always been the case. Until the 1980s; the left and right leaning voters had similar perception levels (Guber, 2013). However, most research has found that left-wing voters are more likely to believe anthropogenic climate change compared to right-wing voters (Leiserowitz, 2006; McCright and Dunlap, 2011; Whitmarsh, 2011; Unsworth and Fielding, 2014; Milfont *et al.*, 2015; Poortinga *et al.*, 2019; Ballew *et al.*, 2020). Ballew *et al.* (2020) highlights that this political differences between left and right wing voters in belief of climate change within the United States increases with higher levels of education and/or income. However, it has been found that the United Kingdom and Europe as a whole is much less divided compared to the United States (Poortinga *et al.*, 2019).

Research has shown that within western countries, as individuals become older, the more conservative they become, in both nature and politically (Cornelis *et al.*, 2009); and as demonstrated political identification has regularly been noted as a cause for the divide in beliefs about climate change.

Traditionally, within the United Kingdom, the Labour party is a left or centre-left wing party; whereas, the Conservative party are centre-right to right wing. However, the 2019 General Election has observed that traditionally Labour voting areas changed to Conservative, which was in part due to lack of implementation of Brexit (Sabbagh, 2019). This change in voting is making it more difficult to define who are the left-wing or right-wing voters. Research will be needed to see if these changes of alliance actually have changed the proportion of left and right wing voters that either support or reject the importance of anthropogenic climate change.

3.2.1.2. Gender

During the 1960s and 1970s, there was no clear evidence that there was a relationship between gender and environmental concerns, including climate change (Van Liere and Dunlap, 1980; McCright, 2010). However, since the 1980s there has been a growing body of literature, which is increasingly suggesting that women are more concerned about the environment and therefore exercise a greater level of pro-environmental values and attitudes than their male counterparts (Greenbaum, 1995; Bord and O'Connor, 1997; Zelezny, Chua and Aldrich, 2000; Dietz, Kalof and Stern, 2002; McCright, 2010; Xiao and McCright, 2012; McCright and Xiao, 2014; McCright and Xiao, 2015). However, some research shows that in rare cases, men have been found to be more environmentally concerned than their female counterparts, such as in China (Xiao and Hong, 2010). Further, in a study by Chan, Pong and Tam (2019) it was found that the environmental concern varies depending on gender inequality.

One of the main theories that have been brought forward for this difference in beliefs is 'gender socialisation theory'. This theory argues that boys and girls are taught from an early age the differences in values and expectations between the genders in their societies culture (Wharton, 2009; Xiao and McCright, 2015). For example, in the western world, boys are taught about behaviour in a masculine way, which means that men are expected to show leadership and be independent, with traits of courage, assertiveness, physical strength and being unemotional (Franklin, 1984). In contrast, girls are taught about and how to behaviour in a feminine way, which means that females are expected to show sensitivity (Windsor, 2015), warmth (Burke and Stets, 2009), empathy (Vetterling-Braggin, 1982), and being emotional and understanding (Kite, 2001).

However, the expectation of masculinity and femininity are evolving with changing attitudes amongst civil society of the United Kingdom and other western nations (Anderson, 2009a; Anderson and

McCormack, 2015). For example, this change can be demonstrated with the raise of metrosexual males and more recently the spornosexual males within both Generation Y and Generation Z (Wolfman, 2017). Both types of men demonstrate a more liberal attribute, which is outgoing emotionally, inclusive and non-judging (Trubo, 2003; Adams, 2011).

In addition, it is likely that gender socialisation theory is having an impact on the level of knowledge that females have on climate change. Research has found that females in Western countries are more likely to have misconceptions about climate change compared to their male counterparts (Ballew *et al.*, 2018). Research has shown that females are less likely to study sciences and mathematics where this is a choice for higher level study, including at college and university (Delaney and Devereux, 2019); this is despite them scoring similar levels to male counterparts in school (O'Dea *et al.*, 2018). There are several potential explanations for this. Firstly, gender socialisation theory highlights that traditionally, hard science is perceived by school students to be masculine (Kelly, 1985). Another is possibly the lack of role models in STEM subjects for girls to inspire (Cheryan *et al.*, 2011). A final potential reason is the females tend to underestimate their ability in STEM subjects and their likelihood to succeed within these types of subjects (Meece *et al.*, 1982; Sax, 1994; Correll, 2001; Ehriliner and Dunning, 2003; Moakler and Kim, 2014).

Overall, the attitudes of masculinity and femininely are changing amongst today's youth.

3.2.1.3. Youth

As previously stated in section 1.2, the terms "youth", "adolescent" and "young person" are often interchanged. This leads to the debate whether the term 'youth' or 'adolescent' is more appropriate within the context of this thesis. Ostensibly, the two terms are identical, with the definition of 'youth', within a western context, being the stage of human life between childhood and adulthood (Kehily, 2007). The definition of 'adolescence' is the transitional period of a human's life between late childhood and the beginning of adulthood (Choudhury, Blakemore and Charman, 2006; Andersen and Vandehey, 2011). However, psychology researchers go further and state that the term also incorporates the social, mental and physical changes that virtually all humans undergo (Roche *et al.*, 2004; Eaton *et al.*, 2006; Ernst, Pine and Hardin, 2006). As a consequence, adolescence deals with the biological and psychological aspects of a young person of a certain age, whilst, youth is a socially constructed term. When exploring young people's relationship with climate change, these two terms should not be mutually excluded from each other, since during the adolescent period, young people's cognitive development is an ongoing process (Paus, 2005).

There are two types of brain development during adolescence. The first is in the regions of the brain that are important for the regulation of emotion, behaviour and the perception, whilst the second is in those linked to the evaluation of both risks and rewards (Steinberg, 2005). For example, it is estimated that within the United States, seventy-one per cent of all adolescence deaths each year are due to car accidents, other unintentional injuries, homicide, and suicide (Eaton *et al.*, 2006). This is relevant to climate change perception, as highlighted within section 1.2 of this thesis, since young people may have this invincibility feeling, that the worst of the effects "won't-happen-to-me".

The other type of youth brain development flagged here is the still developing area of analytical skills and the relationship of this to world views (Vollerbeg, Iedmea and Raaijmakers, 2001). As a consequence, young people start to ask questions about the world around them, rather than accepting the beliefs of 'adults' (Lerner, Lerner and Finkelstein, 2001), and start developing their own unique beliefs through their interactions with different social and cultural environments (Lerner, Lerner and Finklestein, 2001). As such, it is important to provide this age group with new ideas, opinions and ways of understanding to allow them to engage with societal issues and ultimately to help address them.

3.2.2. Weather

On the 26th February 2015, the Senator for Oklahoma, James Inhofe, the new Chairman of the Senate Committee on Environment and Public Works, threw a snowball across the United States Senate to illustrate his point that climate change is a fraud (Fisher, Waggle and Jasny, 2015; Bohr, 2017). This was at a time when in the United States when a polar vortex was bringing historical cold temperatures to the eastern side of the country (Fritz, 2015). He is not the only politician to present the relationship between extreme cold and climate change as a hoax, the others being Donald Trump (Cheung, 2020) and Stuart Agnew MEP (Agnew, 2015). Also, the media have tried to make the link to be wrong in the past, including the Daily Mail (Daily Mail, 2009).

Researchers have suggested that civil society constructs many of their beliefs in real time depending on local and national events (Radvansky and Zacks, 2011), which is arguably to affect people's perception on climate change.

A number of researchers have made the relationship between the levels of perception and resulting concern about climate change and local temperatures (Lorenzoni and Pidgeon, 2006; Joireman, Truelove and Duell, 2010; Li, Johnson and Zaval, 2011; Akerlof *et al.*, 2013; Howe *et al.*, 2013). This has been demonstrated with studies proving that civil society are more likely to believe that climate change is occurring when local temperatures are warming beyond the normal (Krosnick *et al.*, 2006; Egan and Mullian, 2010; Li, Johnson and Zaval, 2011). Some researchers and commentators were starting to make the link between the decline of concern for climate change both within the United States and Europe during the late 2000s and early 2010s as being in part due to the extremely cold and snowy conditions during the winter months, as this goes against perception and imagery of global warming (Perkins, 2010; Moser and Dilling, 2011; Capstick and Pidgeon, 2014). As a result, Knight (2012) has argued that these extreme weather events in part caused the COP15 in December 2009 at Copenhagen, Denmark, to collapse[27].

3.2.3. Uncertainty

Every individual faces a great deal of uncertainty in their everyday activities. For example, driving a car has a degree of uncertainty over the risk of been involved in a car crash, but the vast majority of society accepts this risk; as the level of risk is very low to any one individual albeit high for society as a whole, as meted out by car crash statistics.

Whilst there is near certainty amongst the majority of the scientist that climate change is due to anthropogenic activity; there is a degree of uncertainty of its severity and the risk that climate change poses to the public and future generations.

It has been highlighted by Marshall (2014) that policy makers and campaigners on both sides acknowledge that the climate change uncertainty is important for understanding certainty and uncertainty related actions. As highlighted within article 3.3 of the founding principles of the UNFCCC, the "lack of full scientific certainty should not be used as a reason for postponing … measures" in combating the adverse climatic effects of climate change (UNFCCC, 1992, p.4).

To increase transparency about the uncertainty of climate science to both the public and policy makers, the 5th IPCC Assessment Report in 2013 introduced a likelihood scale, which was brought in to demonstrate the level of probability of claims being made. The likelihood scale is demonstrated in Table 3.1.

Table 3.1 – The Likelihood Scale used within the 5th IPCC Assessment Reports

[27] - It should be noted that 'climategate' occurred during the negotiation of the Copenhagen Climate Conference and this might have played just as important role in the collapse of this discussion. See section 3.3.3.2 for further information about the 'climategate' controversy.

Term	Likelihood of the Outcome
Virtually Certain	99-100% Probability
Very Likely	90-100% Probability
Likely	66-100% Probability
About as Likely as Not	33-66% Probability
Unlikely	0-33% Probability
Very Unlikely	0-10% Probability
Exceptionally Unlikely	0-1% Probability

Source: Mastrandrea *et al.* (2010, p.3)

3.2.4. Mistrust

As highlighted in Johnson (1999), when an individual has a higher degree of trust in an institution or a group, then the individual views the estimates of risk and therefore the hazard policies to be more creditable and acceptable. Unlike many other risks, including health, the risks attributed to climate change cannot be avoided through individual action, but through collective action. Typically, in this type of circumstance, many within civil society want the government to impose different types of regulations and legislation to make people act collectively within a collective nature (Darier and Schule, 1999). O'Riordan and Rayner (1991, p.98) highlight that the overall concept of public trust is that it:

> *"…operates through the cultural and political norms and institutions that frame a person's and a culture's relationship with everything else, including nature. These management systems function because people expect them to function properly. They do not need to know what others are doing. They simply have to feel confident that others are acting with the same sense that the system will work in such a way to improve social well-being. That system could be a government, or a non-governmental organization, or a network of presumed similar behaviours"*

There have been numerous previous studies that suggest that many members of the public have a degree of mistrust in the science and the risks involved with climate change, especially if the messages are coming from scientists and policy makers (Lorenzoni and Pidgeon, 2006). However, this issue affects numerous different sciences from the safety of Genetically Modified (GM) foods and vaccines to Acquired Immune Deficiency syndrome [AIDs] to Darwin's Evolution theory (Casiday, 2005; Lofstedt, 2011; Gauchat, 2012; Kahan, 2013; Westergaard *et al.*, 2014).

Bråten, Strømsø and Salmerón (2011) ran an experiment with students to see how they rate the trustworthiness of difference sources of information when trying to communicate about climate change. It found that those with low background knowledge of climate change were more likely to trust and believe the least trustworthy sources, such as a report from an oil company and newspapers. It is arguable that potentially people with low knowledge of climate change reading two completely different opinions of climate change, could result in confusion and thus reducing the belief of climate change.

"Climategate" was when emails were stolen and released which suggested British and American scientists had altered the research to make global warming seem worse (Leiserowitz *et al.*, 2013). This was at a time when public understanding and acceptance of anthropogenic climate change had been increasing (Leiserowitz, Maibach and Roser-Renouf, 2010). The aftermath resulted in the opposite occurring (Maibach, Witte and Wilson, 2011). This is likely a demonstration of mistrust amongst the public about the science of climate change (Maibach, Witte and Wilson, 2011; Leiserowitz *et al.*, 2013). One researcher described what Climategate did for the global warming controversy as being comparable to what the Pentagon Papers[28] did for the Vietnam War 40 years ago: "It changed the narrative decisively" (Hayword, 2011, Online). However, Anderegg and Goldsmith (2014) have suggested that the impact of the "climategate" controversy was short-lived on climate change perception.

Marris, Langford and O'Riordan (1996) undertook a survey to find which institutions do the public trust to tell them the truth about environmental risks. It was found that the government, companies and the media were least trusted. This is demonstrated in Figure 3.1 with indicates the lack of trust the public have with the government in terms of environmental issues.

[28] - The Pentagon Papers were a set of leaked reports from the Pentagon about the United States efforts before and during the Vietnam War. The fallout of these reports increased the anti-war feeling and which some believe lead to the United States withdrawing from the Vietnam War.

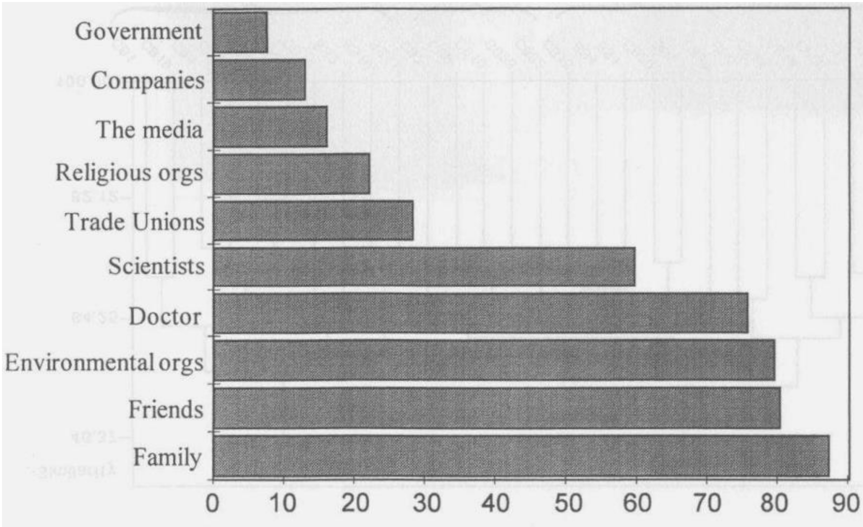

Figure 3.1 – The percentage of respondents who said that they often/always trust an institution to tell them the environmental risk (Source: Marris, Langford and O'Riordan, 1996, p.101)

3.2.5. Climate Change Terminology

The term "climate change" has its origins dating back to at least the 1920s (Willis, 1925). However, since the 1980s, the term 'global warming' has predominantly been used to describe the impacts of the increase greenhouse gas emissions, due to anthropogenic activity, and its effects on current and future climates (Whitmarsh, 2009). It has been highlighted by Houghton (2004) that the metaphor of "warming" has been effective in capturing the public attention to the issue. However, it does not demonstrate the complexities of the climate system and potential global risks that climate change is expected to trigger.

The two terms have different technical definitions. The term 'global warming' only refers to the increase in global surface temperatures (Jacobs *et al.*, 2016). Whereas, the term 'climate change' does not just refer to the increase of temperatures both at a local and global scale, but also describes the changes in climatological features and/or processes due to these temperature changes, including the prevalence of extreme climatic conditions (Meehl *et al.*, 2000). For example, the alteration of spatial distribution of precipitation globally (Trenberth, 1998; Sorribas *et al.*, 2016); the distribution and frequency of droughts (Dai, 2013); and the location, frequency and intensity of tropical storms (Knutson *et al.*, 2010).

However, research being conducted by climate researchers has highlighted that civil society view these two terms in completely different ways. Whitmarsh (2009) found that 79.8 per cent of the British civil society thought that global warming was an important issue compared to 66.6 per cent for the case of climate change. This seems to suggest that there is a difference in which individuals within the British civil society cognitively frame each issue. This study is now 11 years old and with increased usage of climate change, it is possible that these differences might not be as large or even statistically exist now.

These are not the only two terms that have been used regularly to describe climate change. The term 'climate emergency' has been increasing in frequency within the last couple of years. This is demonstrated as the term was declared the word of the year in 2019 by Oxford Dictionaries (Zhou, 2019), as they said that the usage of the word increased by a hundred fold compared to the previous twelve months.

3.3. Climate Scepticism

Climate sceptics are defined as people who express doubt about either the cause and/or credibility of scientific climate change consensus (Anderegg *et al.*, 2010), whereas, a climate change denier is somebody who dismisses the scientific consensus of climate change (Anderegg *et al.*, 2010; Powell, 2012). This is despite a report by Alexander *et al.* (2013) demonstrating that the majority of the warming in the last century is due to anthropogenic activity. It should be noted that sceptics or deniers of science are not a new phenomenon and there has been plenty of research on this previously (Björnberg *et al.*, 2017). The term 'climate scepticism' first emerged in 1995, which was attributed to journalist Ross Gelbspan who authored the first book on the topic (Painter and Ashe, 2012).

Mann (2012) suggests that there are "the stages of denial" within the climate change realm, as follows:

1. Carbon Dioxide and other greenhouse gases are not increasing
2. Increasing levels of greenhouse gases have no impact on climate as there is no conclusive evidence that temperatures are warming
3. If warming is occurring, it has natural origins (for example the Milankovitch Cycle and El Niño)
4. If warming cannot be explained one hundred per cent by natural causes, then anthropogenic causes are small and the impact of greenhouse gases are minimal
5. Even if the current and future human effects are not small on the climate, the changes to the climate will be beneficial to humans and our environment
6. Even if the changes in climate are not beneficial, human are adaptable to change; and besides it is too late to make any major changes and a technological fix will come along

3.3.1. The Heartland Institute

To demonstrate how there are some sceptic groups being used to disseminate misinformation about climate change, this sub-section will explore the work of The Heartland Institute.

The Heartland Institute is a public policy think tank based in the United States, which has conservative and libertarian ideologies (Heartland Institute, 2016). The Heartland Institute was a small regional think tank in the 1990s, which has emerged to become one of the global leading climate change deniers within the last fifteen years (Hoggan and Littlemore, 2009; Dunlap and McCright, 2010).

The Heartland Institute is not just against recognising the problem of climate change, but also other important proven societal issues such as smoking. For example, they published a report by Bast and Sherman (2006) which said that fatality rates of smoking are exaggerated and called second-hand smoking illness as junk science.

In 2009, the Heartland Institute produced a series of 'pseudoscience' reports under the banner of the "Nongovernmental International Panel on Climate Change" [NIPCC]. The purpose of these reports was to offer the counter argument of the IPCC reports, which were published two years previously. The author of the one study by NASA which is cited within the report, Yogesh Sud, stated that the NIPCC "totally misinterpreted my paper" (Tollefson, 2011, p.441). Whilst it cannot be fully certain whether the group deliberately misinterpreted this study within the report, Michael Mann of Pennsylvania State stated that the report "is nothing but a mix of myths, half-truths, cherry-picked distortions, and regurgitated climate-change-denial talking points" (Tollefson, 2011, p.441).

However, this raises questions as to why The Heartland Institute is so against recognising climate change and motivated to attacking those that are concerned about it. It is relevant then to note that the Heartland Institute receives the majority of its funding from the Charles G Koch Charitable Foundation, which is a foundation set up by a billionaire American coal tycoon (O'Brien and O'Keefe, 2013). In addition, they receive additional funding from organisations such as the American Petroleum Institute, Chrysler Foundation, ExxonMobil and General Motors Foundation (Dunlap and McCright, 2010; UCSUSA, 2013). Each of these organisations has an invested interest in the fossil fuel industry, which is vigorously opposed to the theory of anthropogenic climate change; as it is a threat to their industry and these are the largest producers of carbon emissions (Taylor and Watts, 2019).

The Heartland Instituted is not the only group/think tank that is actively promoting climate scepticisms. Others include, but are not limited to, the Global Warming Policy Foundation, and Institute of Economic Affairs (Lawrence, Pegg and Evans, 2019); and the Marshall Institute (Oreskes, Conway and Shindell, 2008; Dunlap and McCright, 2010).

These institutions tend to use information on natural processes to explain away any changes in the environment, whilst some try to discredit climate science through generating controversies. The following sub-sections will explore the use of this type of information in further detail.

3.3.2. Natural Processes

Sceptics have previously used natural processes as the explanation for the recent changes in the climate. This section will explore how these processes have affected the climate previously.

1. El Niño and La Niña – The definition of this process has changed over time. However, El Niño can be defined as the cycle of warm ENSO in the South Eastern Pacific, which usually occurs during the Southern Hemisphere summer months (Trenberth, 1997). The most famous example of El Niño affecting global temperatures occurred in 1998. Global temperatures in 1998 were 0.2°C above the trend line (Hansen *et al.*, 2006), which was not matched until 2015. This resulted in some climate sceptics/deniers to say that climate change was not occurring, or at the rate that scientists were predicting, due to a pause in warming. However, research has demonstrated that there is a potential for El Niño to intensify due to climate change.

2. Milankovich Cycle – The Milankovich Cycles describes the change in the obit of the Earth and how this impacts on the Earth's climate system (Holden, 2008a). Some climate sceptics have highlighted that the climate has changed in the past, using the example of the Ice Age. It cannot be argued that the Milankovich Cycle, or more specially the eccentricity cycle, has had negative and positive changes in global temperatures, and therefore levels of ice on the planet (Hays, Imbrie and Shackleton, 1976; Abe-Ouchi *et al.*, 2013). However, the changes that the cycles bring to the Earth's climate happen over thousands of years, not over a hundred years. In addition, the Earth should be coming to the end of an inter-glacial period, if natural cycles were the dominant factor (Renwick, 2019).

3. Solar Sunspots and Solar Activity – Past research has suggested that solar activity has previously had an effect on global temperatures. For example, Spörer Minimum between 1460 and 1550; and the Maunder Minimum between 1645 and 1715 were periods in history where low solar history correlated with low global temperatures (Shindell *et al.*, 2001; Lockwood *et al.*, 2010; Lockwood *et al.*, 2017). A similar solar minimum to that of the mid to late 1600s today, would result in a global temperature drop of 0.3°C (Feulner and Rahmstorf, 2010). This would only slightly offset the temperature increase that has already occurred.

4. Volcanic Eruptions – In the past, society has observed that explosive eruptions can have a cooling effect on global temperature. An example of how volcanic eruptions can affect global temperatures occurred with the 1815 Mount Tambora eruption[29] in Indonesia, which led to a few severe climate abnormalities lasting for several years. The following year, 1816, become known as the "Year without a summer" (Stommel and Stommel, 1979). An example of why it got its name is demonstrated in that there was snowfall within New York State during July (Stothers, 1984). It is estimated that the average global temperature decreased by between 0.4°C and 0.7°C, with the largest decline experienced in North America and Europe (Klingaman and Klingaman, 2013). This demonstrates how a highly explosive volcanic eruption can have consequences on the global climate for the following few years. Similar cooling events were experienced in the aftermath of the 1783 Laki eruption (Sigurdsson, 1982), the 1883 Krakatoa eruption (Bradley, 1988) and the 1991 Mount Pinatubo eruption (Ward, 2009).

3.3.3. Climate Change Controversies

Groups, such as The Heartland Institute have meant that climate change has remained one of the most controversial issues for the current population and which is already, or is going to, affect every society on the planet. Whilst it is accepted as fact amongst most climate scientists (Cook *et al.*, 2013), it is still a highly debated issue amongst society, as demonstrated in section 2.2 of this thesis. There have been some controversial events that have occurred in the last twenty years, which have been used to fuel this doubt amongst the public. The following sub-sections will highlight three of these controversial events. These are the 'Warming Pause', 'Climategate', the 'Hockey Stick Model' and 'Mistakes in the IPCC reports'.

3.3.3.1. Warming Pause

Between 1998 and 2013, it was observed that global temperatures had not exceeded the 1998 temperature (Schiermeier, 2013). This led numerous climate sceptics such as Monckton (2015) to state that it demonstrates that global temperatures are not warming, and therefore proving that anthropogenic climate change is false. It should be noted that climate change and/or global warming

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[29] - The Mount Tambora eruption occurred between the 5th and 17th April 1815, with a Volcanic Explosively Index of 7 out 8, and index number which was the largest since the eruption of Mount Rinjani in 1257 and not been matched since.

does not mean that every year is going to be warmer than the previous. This is because there are a number of different natural processes that have impacts on the climate change, with the vast majority only impacting on the global climate in the short term. Since 2013, the previous five years were all warmer than 1998 (Vinas Garcia, 2020), which further demonstrated that global temperatures in 1998 were abnormally high.

3.3.3.2. Climategate

The "Climate Research Unit email controversy", commonly known by both academic community and the media as "Climategate" (Chameides, 2010; Pearce, 2010a; Leiserowitz *et al.*, 2013), was the hacking and theft of emails from the Climate Research Unit based at the University of East Anglia by an external hacker in November 2009 (Revkin, 2009). The selection of stolen emails was published on the internet (Chameides, 2010).

Climate sceptics and right-wing media believed and promoted that the climategate emails were proof that the current climate change is false. Some proclaimed that there was a conspiracy to exaggerate temperature warming data and delete any data that suggested anthropogenic climate change was not happening. This is demonstrated from a Daily Mail headline in November 2011, which stated "Climategate scientists DID collude with government officials to hide research that didn't fit their apocalyptic global warming" (Waugh, 2011, Online).

Meanwhile climate scientists believed that the leak was timed to coincide with the 15th Conference of the Parties Conference in Copenhagen, to undermine the negotiations, as it was leaked two weeks before the start of the negotiations. In addition, it has been attributed by some that Climategate was one of the causes for the collapse of the negotiations, and the whole conference was labelled by a German journalist as a "political disaster" (Traufetter, 2010).

In the aftermath, there were at least eight separate inquiries held within both the United Kingdom and the United States by the House of Commons Science and Technology Committee [STC]; the Independent Climate Change Email Review; Department of Commerce; National Science Foundation; the United States Environment Protection Agency; and two by Pennsylvania State University (Russell *et al.*, 2010; Willis *et al.*, 2010; CBC News, 2011; Ward, 2011). The aims of the investigation were to examine the allegations of falsified scientific data and potentially misleading the public. In all the inquiries, it was found that within all cases, the climate scientists did not mislead the public (Russell *et al.*, 2010) with falsifying data (Foley, Scaroni and Yekel, 2010; Zinser, 2011). In addition, it was highlighted by the United Kingdom's Science and Technology Committee that their "actions were in line with common practice in the climate science community" (Willis *et al.*, 2010, p.3).

Ward (2011) believed that this was demonstrated, as the coverage of findings from the following inquiries was muted in comparison. This could be viewed as one example of how some sectors of the media are not giving equal reporting of the climate change issue; further review of the media's reporting of the issue of climate change is explored later within this chapter.

However, despite near exonerations of the scientists, a consequence was a decline in the public belief and concerns about climate change in forthcoming years. Further information about the impact that this event had are available in Section 3.2.4 of this thesis.

3.3.3.3. Hockey Stick Model

Mann, Bradley and Hughes (1999) produced a chart of the average global surface temperatures for the Northern Hemisphere over the last 1,000 years, as demonstrated in Figure 3.2. The chart demonstrates that the current temperature is warmer than any point over the last 1,000 years, with a sharp experiential increase during the last 200 years. As highlighted in Section 2.1, this happens to coincide with the increased levels of carbon dioxide within the atmosphere due to anthropogenic activity, which was instigated by the Industrial Revolution. This model was completed using climate proxy records and instrumental temperature records. This model built upon work with climate reconstruction of the Northern Hemisphere for the last 500 years (Mann, Bradley and Hughes, 1998).

However, a report by McIntyre and McKitrick (2003) criticises the hockey stick model, as they highlight that it is based upon a flawed methodology. They state that the model had "collation errors, unjustifiable truncation or extrapolation of source data, obsolete data, geographical location errors, incorrect calculation of principal components and other quality control defects" (McIntyre and McKitrick, 2003, p.751). These claims were due to the lack of temperature change demonstrated from either the Medieval Warm Period[30] or the Little Ice Age[31]. However, these claims were refuted by Wahl

[30] - The Medieval Warm Period, later to become known as the Medieval Climatic Anomaly, occurred between c.950 to c.1250. It is a period of history where temperatures changed in the North Atlantic region, which is where most of the population lived at the time. The reason for a lack of temperature increases on the Hockey Stick Model and other temperature reconstructions are due to the temperature decline in other regions, such as the Tropical Pacific (Mann *et al.*, 2009).

[31] - The Little Ice Age refers to the period between the 16^{th} and 19^{th} century (Mann, 2002), but sometime is defined as between 1300 and 1850 (Miller *et al.*, 2012). This is a period in history where there were colder than average weather conditions within the Northern Hemisphere (Lamb, 1995).

and Ammann (2007), who highlight that whilst there might be a slight difference in the first part of the model, the general trend is correct. Due to this criticism, its inclusion within the 3rd IPCC report was highly controversial (de Freitas, 2002), as there was plenty of debate amongst the academic community about the true validly of the Hockey Stick Model.

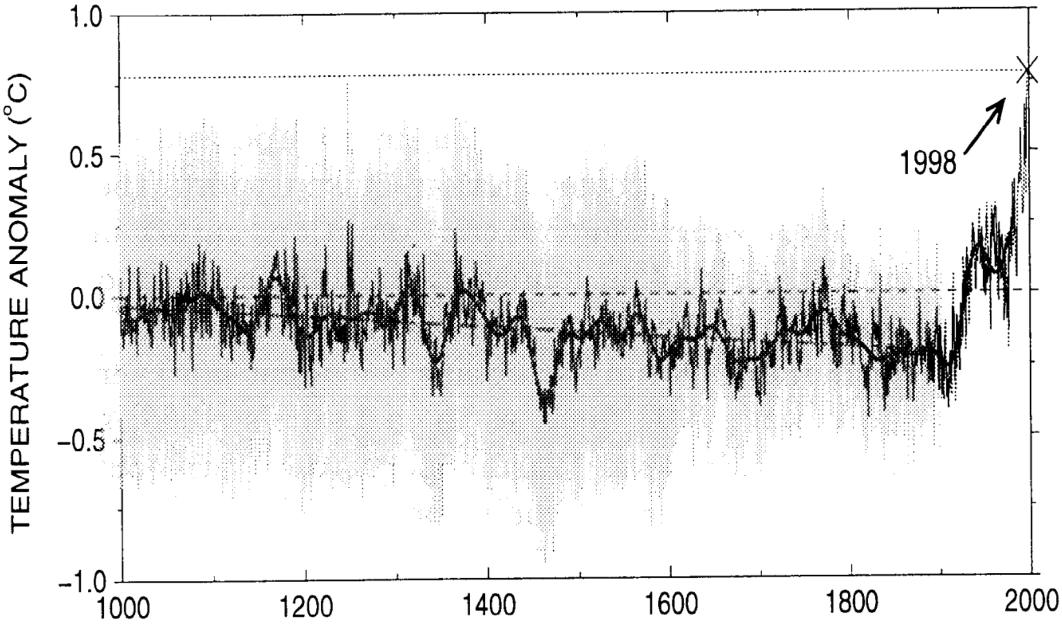


Figure 3.2 – Northern Hemisphere temperature anomaly (°C) between 1000 and 2000 (Mann, Bradley and Hughes, 1999)

In recent years, further reconstructions have been undertaken by different climate scientists. Most of these reconstructions demonstrate the same sharp increase in global temperatures starting in the last 20th century (Kaufman *et al.*, 2009; Marcott *et al.*, 2013), therefore consistent with the Hockey Stick Model.

3.3.3.4. IPCC Mistakes

Within the 4th IPCC report, Cruz *et al.* (2007, p.493) stated that the "glaciers in the Himalaya are receding faster than in any other part of the world … the likelihood of them disappearing by the year 2035 and perhaps sooner is very high if the Earth keeps warming at the current rate". The board of the IPCC later admitted that this was an incorrect statement. It was found that this claim was based upon three reports that were not peer-reviewed, which led to the debate as to whether grey literature should be appearing in these types of reports (Pearce, 2010b).

This has resulted in climate sceptics, such as Laframboise (2011) to state that the IPCC reports cannot be trusted due to these types of errors. However, FOEI (2010) defended these reports by stating that only one mistake in over 3,000 pages of climate change reporting does not mean that all the research should be discredited.

3.4. Education

Bangay and Blum (2010) highlight that education is vital in combating climate change and should not be forgotten. In addition, it is highlighted by the United Nations Educational, Scientific and Cultural Organisation [UNESCO] (2009) that education should help people to understand the changing climate and how best to mitigate against and adapt to the changing climate.

In 1992, all countries that were members of the United Nations (UN), including the United Kingdom, signed the UNFCCC agreement. Within this agreement, Article 6 is devoted to 'Education, Training and Public Awareness' of climate change. Further to this, Article 10e of the Kyoto Protocol, states the following:

> *"Cooperate in and promote at the international level, and, where appropriate, using existing bodies, the development and **implementation of education and training programmes**, including the strengthening of national capacity building, in particular human and institutional capacities and the exchange or secondment of personnel to train experts in this field, in particular for developing countries, and facilitate at the national level public awareness of, and public access to information on, climate change"*
>
> United Nations (UN), 1998, p. 10

As demonstrated within the Kyoto Protocol, the United Nations highlights the need for education and training programs towards the public in order to help develop their understanding of the climate change issue, which builds the national capacity. This demonstrates that the UN believes that education has a critical part to play in the development of a climate change narrative. This belief in the role of education is supported by social scientists (Cherry, 2011; Sharma, 2012). One study by Cherry (2011) highlighted that young people have a tendency to communicate their studies to their parents, thus increasing the transfer of knowledge. Similar results have been found by Mochizuki and Bryan (2015).

A report by Grantham Research Institute on Climate Change and the Environment highlights that

> *"there can be no justification for omitting climate change from the National Curriculum, and the education of pupils would be deficient if they did not receive teaching about it …*

if core climate change teaching is not included as compulsory learning … there is a risk that some students would not acquire essential basic knowledge about climate change. As the UK Youth Climate Coalition points out, "climate change is too important to be left to individual teacher choice"

Hicks, Ward and Lester (2013, pp.3-5)

3.4.1. Climate Change Education within the United Kingdom

Within the United Kingdom, some form of formal education is compulsory until the age of 18. However, from the age 14, the students have the ability to drop some subjects that they are not interested in, one of which is geography, which is where most of the climate change education occurs within the British education curriculum (George, 2017). In the school year 2015-16, 41 percent of 15 and 16 years undertook General Certificate of Secondary Education [GCSE] Geography (Carroll and Gill, 2017). This demonstrates that most students are not receiving extensive knowledge about climate change. However, it should be noted that elements of climate change education are still available post-14, be it assiduous to carbon dioxide and methane increases and the uncertainties of the impact this has on climate change (DfE, 2014a; George, 2017). Basic education may, for example, present these as the most concentrated and potent greenhouse gases in the atmosphere respectively, but neglect to go into the details as to how they are not the only greenhouse gases that contribute to climate change.

The education of climate change is important in trying to combat it, as students and other young people become informed about the sources, impacts and different strategies to both mitigate and adapt. The hope is that they start to adopt more environmentally friendly behaviour (UNESCO, No Date).

A number of countries and regions globally, such as Brazil, China, Denmark, Singapore, South Africa, South Korea and Vietnam, have adopted climate change in the national curriculum in recent years (Han, 2015; Læssøe and Mochizuki, 2015; Sung, 2015; Trajber and Mochizuki, 2015; Chang and Pascua, 2017). However, despite this progress, other countries, such as New Zealand, are still teaching limited amount of climate change, if any at all (Eames, 2017).

In the United Kingdom, climate change first appeared on the national curriculum in 1995; it has featured regularly despite rumours in the majority of major national newspapers that it was under threat of been taken off the curriculum in 2013 (DfE, 2013a; Coughlan, 2017).

Within the current geography curriculum, climate change is taught at different levels. Within Key Stage 3[32] the national curriculum states that students should be taught about key processes within physical geography, such as "weather and climate, including the change in climate from the Ice Age to the present; and glaciation" and "understand how human and physical processes interact to influence, and change landscapes, environments and the climate; and how human activity relies on effective functioning of natural systems" (DfE, 2013b, p.2). This demonstrates that students should be given the basic fundamentals of climate change as they start secondary school within England. Within the Key Stage 4[33] curriculum, whilst there is education of climate change, it is very limited and is very similar to the Key Stage 3 with only one brief mention, which states:

> *"Changing weather and climate – The causes, consequences of and responses to extreme weather conditions and natural weather hazards, recognising their* ***changing distribution in time and space*** *and drawing on an understanding of the global circulation of the atmosphere. The* ***spatial and temporal characteristics, of climatic change and evidence for different causes, including human activity****, from the beginning of the Quaternary period (2.6 million years ago) to the present day."*

DfE (2014b, p.6)

This demonstrates that the amount of climate change education within the national curriculum is very limited. Further, the inclusion of climate change on the national curriculum within the United Kingdom has not been without controversy. During the mid-2000s, the United Kingdom government started to increase the amount of climate change included within the national curriculum. This is demonstrated when the government announced that the academic year 2006/07 would be the "Sustainable Schools Year of Action", with the underlying aims to promote sustainable development and other environmental concerns, for example climate change (DfES, 2006). This led to all schools within England, Scotland and Wales being given a free copy of Al Gore's 'An Inconvenient Truth'. In addition, the government announced guidance notes and resources about how climate change fits within the national curriculum alongside the Al Gore documentary (WalesOnline, 2007). However, in May 2007, a court case was brought by Stewart Dimmock, who took legal action against the Secretary of State for Education and Skills, in an effort to stop Al Gore's 'An Inconvenient Truth' being shown in schools. It should be noted that Stewart Dimmock, had 'backing' from Viscount Monckton (Leake, 2007), who is a prominent climate change sceptic. The court ruled that the film "is substantially founded upon scientific research and fact, albeit that the science is used, in the hands of a talented politician and

[32] - Key Stage 3 within the United Kingdom is usually for children between the ages of 11 and 14

[33] - Key Stage 4 within the United Kingdom is usually for children between the ages of 14 and 16

communicator, to make a political statement and to support a political programme." (Dimmock vs. Secretary of State for Education and Skills, 2007, Online). Therefore, he ruled that an amendment is needed to the notes to highlight that there are alternative points of views and that teachers need to highlight the nine mistakes within the film.

Currently, most teaching is done by conventional methods, such as movie and students listening to a teacher. The problems of these methods are they are prone to students losing attention throughout the lesson, which leads to the question as to how much of the information they obtain, let alone personalise and act upon?

3.4.2. Attention Rates of Students

There is a growing body of research on how student's attention within classes declines throughout a lesson (Davis and Buskist, 2002; Bradbury, 2016). However, there are slightly conflicting results as to when, and the length of time, it takes for students to lose concentration. Sousa (2006) suggests that the unmotivated students will start to lose focus within the first ten to twenty minutes of a lesson. This finding is backed up by similar observations of Davies (1993), Benjamin (2002) and Wankat (2002).

However, other research has found that that there are cycles in concentration of students' lapse (Johnstone and Percival, 1976; Bunce *et al.*, 2010). For example, Johnstone and Percival (1976) state that lapses in student's attention tend to last between two and four minutes, as students settle into the lecture, and then between ten and eighteen later. In addition, they found that by the end of lesson, the average lapses of attention by the students were occurring every three to four minutes.

Despite these differences in opinion amongst researchers, one thing that can be agreed upon by nearly all researchers is that the attention rate in the class declines throughout the class; with attention lapse becoming more frequent and longitudinal. Therefore, methods are needed to try and keep the student's attention rate throughout the period.

One suggestion by Sousa (2006) is that classes should be split up into segments of between 15 and 20 minutes; as a method of keeping the students' attention throughout the lesson. Other suggestions are that alternative features should be used within lessons to keep the attention of the students (Brunce *et al.*, 2010). Later in this thesis a method that was implemented as a part of this new research was implemented to examine not only attention but also test a fuller engagement with the issue being taught.

3.4.3. Experiential Learning and Risk Perception

The basic definition of experiential learning is the process of learning from experience. This is done by reflecting on the doing (Felicia, 2011). Sometimes, the process is termed “experiential education”, but this involves a broader philosophical approach to education, whereas experiential learning considers the learning process for each individual (Breunig, 2009).

The concept of Experiential Learning was first developed in the early 20th Century by John Dewey. Dewey (1933) suggested that humans are active and problem-solving species that continuously develop intelligence and capacity through the use of reflection of experience. This process is demonstrated in Figure 3.3.

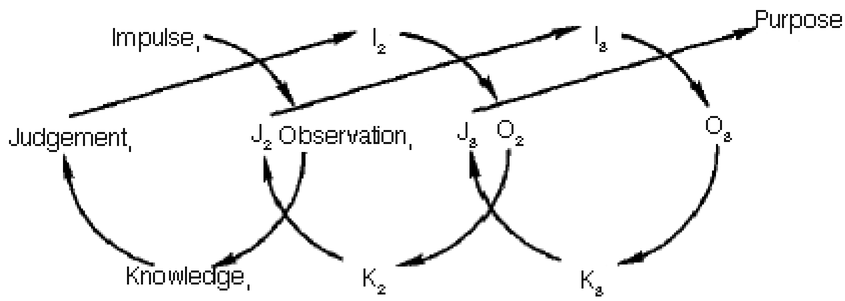


Figure 3.3 – Dewey’s Model of Experiential Learning (Kolb, 1984, p.23)

This work was built further by Kurt Lewin in 1951, who developed a model which highlights that there are four distinctive stages, which is demonstrated within Figure 3.4. This model is particularly useful during the aftermath of climate related events, when deciding how to better adapt in the future, as there is emphasis on how observation and reflection develop.

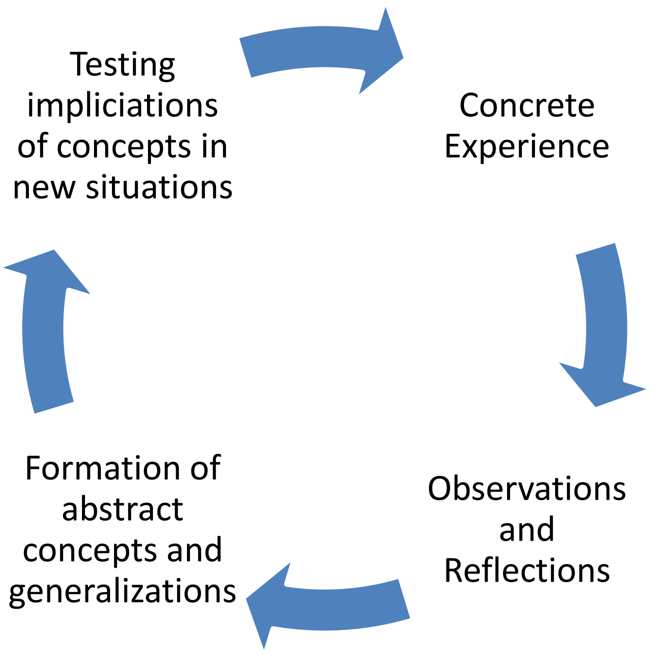


Figure 3.4 – The Lewinian Experiential Learning Model (Kolb, 1984)

When exploring climate change perception in relation to risk perception, it is highlighted that direct experience can change an individual's evaluation of environmental threats, especially climate change (Slovic, Fischhoff and Lichtenstein, 1981). It is arguable that this is one of the fundamental barriers to climate change action, as most of the public have not experienced ***extreme*** meteorological events. This is especially true, as climate change refers to a long-term period, not just one short-term impact, for example, the heatwave that impacted the United Kingdom in 2019. However, reaction to these events raises the discussion about the rating of the issue amongst civil society.

The many risks around us, including those associated with climate change, are generally under-estimated amongst the civil society (Kahneman, Slovic and Tversky, 1982). However, risks that are more locally felt tend to be of greater importance compared to those of global risk (Hinchliffe, 1996). This means that an individual's experience is fundamentally more important in perceiving the existence of a risk compared to second-hand information (Demski *et al.*, 2017). As a result, it can potentially lead to greater engagement with climate change actions (Lorenzoni and Pidgeon, 2006; Weber, 2010; Reser, Bradley and Ellul, 2014; McDonald, Chai and Newell, 2015). This is because these individuals have a greater understanding of the impacts associated with the risk of climate change (Bickerstaff and Walker, 2001; Spence, Poortinga and Pidgeon, 2012; Smith and Joffe, 2013). In addition, Myers *et al.* (2013) found that within the United States, experimental learning about climate change mainly occurs amongst people that are less engaged in the climate change issue. This is because individuals are more likely to trust their own senses. This direct perception has been observed with other environmental issues. For example, plastic pollution can be directly observed in person in the media and is known to have negative impacts on human health (Heidbreder *et al.*, 2019). Likewise, research has demonstrated that people find that climate change is a creditable explanation for observed changes in the weather compared to what they experienced during their youth (Kempton, 1997).

Therefore, experiential learning is important to truly understand climate change, but many will either not directly experience climate change or not make the connection. Consequently, it is critical that the media can portray climate change in a way that is factual and accessible to the general public. Renewed discussion about climate change within the United Kingdom in 2019 and 2020 due to the media's coverage of the Extinction Rebellion protests in London and the Australian Bushfires may have an influence going forward. What may or may not influence these actions undertaken by civil society is also a part of the exploratory research of this thesis.

3.5. Media

Mass media is defined as the production and diffusion of messages to the population (Chandler and Munday, 2011). Today, this is undertaken in a number of different ways including newspapers, television, movies and social media.

The Eurobarometer (2007) undertook a survey throughout the European Union to determine what news related issues the public were interested in, with a maximum of three answers available. It was found that scientific research, such as on climate change, was ranked the fifth most popular out of the eight at 31 per cent. In addition, it was found that within the United Kingdom, this number is lower at 29 per cent; see Appendix Q for the full figures. This demonstrates that only just over a quarter of the population are interested to find out the latest scientific research, albeit this varies between 13 per cent in Czech Republic and 56 per cent in Sweden.

The following section critically explores the link between media and climate change.

3.5.1. Media Coverage of Climate Change

Studies have found that most of the population's understanding of science and climate change is via the media (Wilson, 1995; Wilson, 2000; Carvalho and Burgess, 2005). Therefore, media coverage greatly influences public opinion on climate change (Anderson, 2009b; Antilla, 2010). This means the media are important in the role of "constructing" the issue of climate change to the public (Hannigan, 1995). Nelkin (1995) states that good media coverage on the issue could engage and empower the public with the climate change issue, whilst the opposite can happen with poor media coverage.

As highlighted by Beck (1995, p.65) “no mass media information, [results in] no consciousness of risk”. Research by Nelkin (1995, p.71) found that news articles on the existing risks “can lead to dramatic changes in behaviour”. This demonstrates that by the media highlighting the risks that climate change is currently creating, the public are more likely to engage with climate change and undergo a behavioural change.

It has been observed by Boykoff et al. (2019) that the amount of attention that the media gives to climate change fluctuates. This is highlighted by Boykoff and Roberts (2007) who demonstrated that during 2005 and 2006, there were two spikes in the amount of climate change coverage within the UK’s media. These spikes occurred in June/July 2005 and September to November 2006, which is demonstrated in Figure 3.5. The first spike contributed to the Group of Eight (G8) summit held in Glenegales, Scotland. The summit had a partial focus on climate change, but came under scrutiny by the media about the need to fly in so many people to talk about climate change. The media highlighted that flying this large number of people to the G8 summit would substantially contribute towards climate change. The other spike in media attention between September and November 2006 was a combination of four major events. These four major events are:

1. Al Gore’s ‘An Inconvenient Truth’ which was released within the United Kingdom during September
2. Richard Branson’s donation of £1.8 billion to biofuel research and renewable energy initiatives
3. The ‘Stern Review on the Economics of Climate Change’, which was ordered by the then Prime Minister, Gordon Brown, and was released on 30th October
4. On November 4th, the ‘Stop Climate Chaos’ group held a rally in London’s Trafalgar Square. This event was held in correlation with the Twelfth Conference of Parties (COP12) meeting held in Nairobi, Kenya.

This fluctuation in the media coverage on issues, such as climate change, can cause fluctuations in concern amongst the public (Mazur and Lee, 1993).

The shift of news towards online and cable television has created myriad news coverage. However, this is leading to what Feldman et al. (2014) describes as “echo chambers”. Jamieson and Cappella (2008) describe echo chambers as occurring when individuals only expose themselves to opinions that fit their personal beliefs, which can include climate change (Dunlap, 2013). Stroud (2011) found that this leads to a polarization of attitudes amongst the public towards scientific issues, such as climate change. Experts have warned that blogs could be or are becoming concentrated echo chambers, in which people are exposing themselves to beliefs that they already hold (Sunstein, 2006).

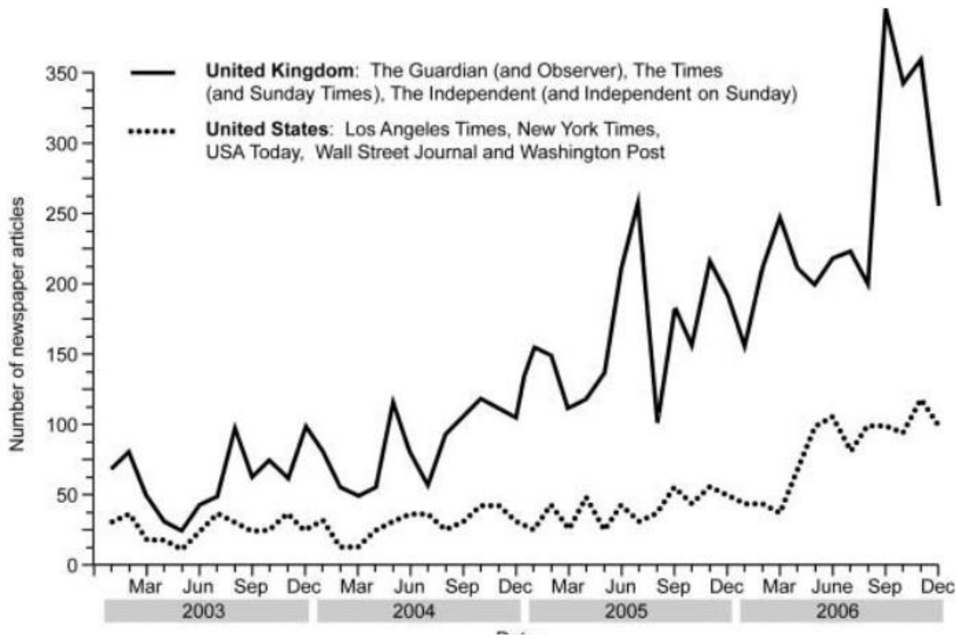


Figure 3.5 – The amount of newspaper coverage of climate change between 2003 and 2006 (Boykoff, 2007, p.473)

This sub-section has broadly focused on how climate change is consumed through the media at an international level within Western Societal context. The following sub-section will increasingly focus on the British media in general and how they have reported on climate change.

3.5.2. The British Media

Within the United Kingdom, the sales of newspapers have been in decline since the 1950s (Thompson, 1990). The average daily circulations of newspapers have declined from 38.4 million in 1965 to 32.6 million in 1985. However, it sharply declined to 22.7 million in 2007 (Franklin, 2008). Table 3.2, demonstrates the average daily circulation of each newspaper compared to their online viewership. It can be observed that for the majority of the newspapers, the online daily viewership is significantly higher than average daily newspaper circulations. However, it should be noted that online daily viewing figures also include people from outside the United Kingdom; this is especially true for the Daily Mail which has an Australian and United States version.

Tabloid journalism has less depth in reporting with an increase of representation of issues that are simplistic and sensationalist; with a greater focus on entertainment and sports than political and environmental issues (Djupsund and Carlson, 1998). Table 3.3 presents examples within the United Kingdom tabloid media of headlines that have been used in recent years to discuss climate change.

Table 3.2 – Average Daily Circulations of Newspaper and Online Viewership within the United Kingdom during March 2016

Newspaper	Average Daily Circulation	Online Daily Viewing	Type of Newspaper
The Sun	1,739,206	2,255,172	Tabloid
Daily Mail	1,576,121	14,390,593	"Middle-Market" Tabloid
Metro	1,346,414	1,194,511	Freesheet
Evening Standard	891,746	498,764	Freesheet
Daily Mirror	784,122	4,455,426	Tabloid
Daily Star	485,652	706,253	Tabloid
Daily Telegraph	481,525	4,172,345	Quality Press
The Times	420,570	N/A	Quality Press
Daily Express	415,022	1,218,492	"Middle-Market" Tabloid
I	270,182	N/A	Quality Press
Financial Times	202,836	N/A	Quality Press
Daily Record	173,061	N/A	Tabloid
The Guardian	164,630	8,821,223	Quality Press
City A.M.	96,124	N/A	Freesheet
The Independent	54,984	3,082,936	Quality Press

Source: Ponsford, 2016a; Ponsford, 2016b

In February 2017, the Daily Mail ran a story about how climate change data was manipulated in the run up to the Paris COP in 2015 (Rose 2017). However, this article was referred to the Independent Press Standards Organisation, where it was found that the Daily Mail/Mail on Sunday had broken Article 1 (accuracy) of the Editors Code of Practice. It was highlighted that it was inaccurate and was misleading the public. This article, along with strong and emotive language, such as "Exposed", "Killer" and "Monster", demonstrated that the tabloid newspapers are misrepresenting climate change with sensationalised stories to sell newspapers. However, it highlights the questions: Do people who read tabloid newspapers have a negative impact on the wider world's awareness and actions on climate change? If so, do tabloid newspaper readers believe that climate change should be reported less in the media?

Boykoff (2008) found that tabloid newspapers within the United Kingdom tend to report on climate change through extreme climatic events, for example flooding, and movements of political actors, whereas there have been very few stories with the focus on climate change science and the risks associated with climate change.

Table 3.3 – Example of Climate Change Headlines within British Tabloid Newspapers

Title	Newspaper	Reference
GLOBAL COOLING: Decade long ice age predicted as sun 'hibernates	Daily Express	Austin (2015)
'Global warming the greatest scam in history' claims founder of Weather Channel	Daily Express	Taylor (2015)
What Global Warming? USA temperatures DOWN as climatologists claim 2015 was hottest year	Daily Express	Austin (2016)
Greta Thunberg outrage: BBC viewers furious as it announces activist series – 'Not paying'	Daily Express	Day (2020)
Climate change targets 'will add £500 to family's fuel bill within four years'	Daily Mail	Groves (2011)
The fatcat ecocrats exposed: Web of 'green' politicians, tycoons and power brokers who help each other benefit from billion raised on your bills	Daily Mail	Rose (2013a)
Stunning new data indicates El Nino drove record highs in global temperatures suggesting rise may not be down to man-made emissions	Daily Mail	Rose (2016)
More monster wind farms are set to loom over Britain Coast but power will cost 40% less than Hinkley	Daily Mail	Poulter (2017)
Exposed: How world leaders were duped into investing billions over manipulated global warming data	Daily Mail	Rose (2017)
Plummeting temperatures could send the world into a 'mini ice age' in 2030 and could OVERRIDE global warming, claim mathematicians	Daily Mail	Weston (2017)

Monster tsunami warning for UK as climate change raises risk of giant deep sea landslide	Daily Star	Havis (2016)
Climate change warning: Killer winter storms for next THIRTY years	Daily Star	Young (2013)

However, in a survey undertaken by Ofcom (2004), it was found that two in three people believe that television news provides the most unbiased and fair news reporting. Examining how the public are consuming news within the United Kingdom, a study carried out by Whitmarsh (2009) highlights that the public within the United Kingdom are mostly likely to gain their scientific knowledge through mass media, in particular Television (91.5 per cent) and Newspapers (85.1 per cent). It was also highlighted that the public are less likely to use journals (18.7 per cent), libraries (7.1 per cent) and the internet (13.2 per cent). A similar trend was observed in MORI (2005). However, there is likely to be a change in these figures. With the drastic increase in usage of the internet in recent years, it is increasingly likely that the internet will have a far higher proportion. This includes mass engagement with social media. The following sub-section will explore social media and how it tends to report climate change.

3.5.3. Social Media

Generally, social media is a broad category of media which allows social interaction between groups of people (Chandler and Munday, 2011). Using this definition it can be argued that traditional media can be viewed as social, as it always has provoked discussion amongst people. But, Obar and Wildman (2015) argue that social media is typically viewed as the interaction between individuals using web 2.0 internet. This includes smartphone communication, for example WhatsApp and Viber.

Today, there is a multitudinous use of social media websites. Increasingly, social media is becoming a source of news consumption. As highlighted in Table 3.4 at least a quarter of the population within the United Kingdom use social media to consume news. This increases to at least 41 percent in the under 35s. As demonstrated, the social media website Facebook is the most used for the consumption of the news. Most major news outlets within the United Kingdom have both a Facebook and Twitter page, which provide updates throughout the day of the latest news.

Table 3.4 – Social Media News Consumption within the United Kingdom

Rank	Social Media	% All	% U35s
1	Facebook	28	41
2	Twitter	12	20

3	YouTube	7	11
4	WhatsApp	3	5
5	LinkedIn	2	3

Source: Newman *et al.* (2016)

In the last five years, traditional media have gradually moved to social media to inform the public about different news stories. There are three ways in which this is done. The first is to give the headline and a link to take them to news articles on their own website, as demonstrated in Figure 3.6. The second is when there is a video attached to the message, as demonstrated in Figure 3.7. The last, is usually reserved for when important news is breaking. Then the news organisation just writes what is happening, as demonstrated in Figure 3.8.

One of main reasons why social media has become increasingly popular is that it provides instant news; and during breaking news situations it can be faster than traditional news. Social media gives ordinary members of the public a chance to become journalists in these situations. For example, in the aftermath of the 2017 Manchester Arena Bombings, information and pictures were shared around Twitter, with many news organisations using this information whilst they tried to get to the scene.

Figure 3.6 – An example of linked news stories on Twitter (Sky News, 2017a)

However, it should be noted that whilst social media has become an important source for news in recent years, its reliability is becoming of increased focus. This increased focus is due to the alleged attacks in the 2016 United States Presidential elections using social media to spread fake news (Allcott and Gentzkow, 2017; Langin, 2018). The following section examines what is meant by the term "fake news", the impacts and what it might mean for climate change.

Figure 3.7 – An example of news on Twitter with a video attachment (Sky News, 2017b)

Figure 3.8 – An example of breaking news format on Twitter (Sky News, 2017c)

3.5.4. "Fake News"

Fake news is defined by Lazer *et al.* (2018, p.1094) as "fabricated information that mimics news media content in form but not in organizational process or intent". These fake news outlets do not have standard processes in place to ensuring the creditability and accuracy of news stories (Lazer *et al.*, 2018).

On Twitter, most fake news stories originate from Twitter Bots. A Twitter Bot is a type of web robot software that controls a Twitter account, and repeatedly tweets fake news using a number. The ability to tell the difference between fake tweets from a Twitter Bot and a real tweet can vary, depending on how well set an account is. Research conducted by Langin (2018) has demonstrated that fake news tweets on Twitter can travel six times quicker than truthful news tweets. In addition, it found that the spread of these fake news tweets can travel further as well. It was also discovered that when removing the 'bots' from these figures, it makes no difference to the speed of fake news tweets compared to the truthful news tweets. This demonstrates how destructive social media can be to real information about climate change.

Similar to fake news is the process of disinformation dissemination. Disinformation is known as the conscious spread of distorted information with the sole purpose to circumvent civil society (Pacepa and Rychlak, 2013). The term originates from the Russian word "*dezinformatsiya*", which was deviated from a Komitet Gosudarstvennoy Bezopasnosti (KGB) propaganda department set up by the Soviet Leader, Joseph Stalin, in the 1920s (Pacepa and Rychlak, 2012). The Great Soviet Encyclopaedia in 1952 defined disinformation as the spreading of "false information with the intention to deceive public opinion" (Bittman, 1985, p.49-50).

As definitions of these two terms highlight, they are very similar to the fake news of today. It could be argued that fake news is virtually the same as both disinformation and misinformation; but is more in line with misinformation. This view can however be highlighted as secondary disinformation processes for misleading the general public as the majority of this is done today within the Twitter Bots.

3.5.5. Celebrity Culture – "Celebritization of Climate Change"

As pointed out by Driessens (2013), in recent years there are increasing celebrity influences in society and culture. Through the help of media, both traditional and modern media, celebrities have become public figures that become 'intimate strangers' (Schickel, 2000).

The rapid increase of celebrity culture has led academic authors to discuss the importance in identity formation (Redmond, 2014) and social cohesion among fans (Marshall, 2010). In recent years, there is a growing awareness among the public about climate change, whereby celebrities have increasingly become a community that are influencing the discourse and actions people may take (Boykoff and Goodman, 2009). Cooper (2008) states this is because celebrities have influence in framing global issues that attract attention, creating new channels of communication. This is demonstrated by actor Leonardo DiCaprio, during his famous Oscars win in 2016, in which he dedicates his victory speech to highlight the plight of climate change as is demonstrated in the quote below. This was hugely important as it brought climate change to the attention of the world's media. Some examples of this are demonstrated in Table 3.5, though in the reporting of stories about celebrities and climate change, echo chambers still exist. This is demonstrated within the Fox News headline that tried to point out that he is championing the issue but is not undertaking action himself.

> *"Climate Change is real, it is happening right now. It is the most urgent threat facing our entire species, and we need to work collectively together and stop procrastinating. We*

need to support leaders around the world who do not speak for the big polluters, but who speak for all humanity, for the indigenous people of the world, for the billions and billions of underprivileged people out there who would be most affected by this. For our children's children, and for those people out there whose voices have been drowned out by the politics of greed. … Let us not take this planet for granted"

Leonardo DiCaprio

Oscars Awards, 2016

Table 3.5 – Examples of Leonardo DiCaprio Oscar Climate Change Headlines

Headline	Newspaper	Country	Author
Leo's Oscar's lecture: DiCaprio uses his long-overdue award for Best Actor to deliver homily on the dangers of global warming	Daily Mail	United Kingdom	Dodge (2016)
Leonardo DiCaprio preaches environmental responsibility, but does he practice it?	Fox News	United States	Fox News (2016)
Leonardo DiCaprio Wins First Oscar, Says "Climate Change Is Real"	Hollywood Reporter	United States	Strause (2016)
Leonardo DiCaprio tackles climate change in Oscars acceptance speech, doesn't mention how long he waited to win	Independent	United Kingdom	Stolworthy (2016)
Leonardo DiCaprio ties his work in "The Revenant" to a greater cause – fighting climate change	Los Angeles Times	United States	Brown and King (2016)
Oscar 2016: Leonardo DiCaprio FINALLY won an Oscar, used speech to talk climate change	Metro	United Kingdom	Lewis (2016)
How Leonardo DiCaprio became one of the world's top climate change champions	The Guardian	United Kingdom	Goldenberg (2016)
Oscars 2016: Kevin Rudd congratulates Leonardo DiCaprio for climate change speech	The Sydney Morning Herald	Australia	Bourke (2016)
Leonardo DiCaprio uses Oscars speech to address climate change	The Washington Times	United States	Morton (2016)

During the 2019 Extinction Rebellion protests[34], some celebrities expressed their support for the protests, including Mel C, Bob Geldof, Sir Mark Rylance and Ray Winstone (Extinction Rebellion, 2019). In addition, celebrities and politicians joined the protests, including Jonathan Bartley, Caroline Lucas, Greta Thunburg, and Emma Thompson. Currently, there is no research on the trust of and the impact that celebrities have on the communication of climate change. The following section explores the background of environmental and climate activism overall and within the United Kingdom.

3.6. Environmental and Climate Activism

Ockwell *et al.* (2009) states that climate activism is an effective approach to achieve action on reducing greenhouse gas emissions, as governments are not willing to act without the pressure of the voting public and individual conservation/action will not be enough to tackle the scale of the problem. It has been argued that the cap-and-trade system introduced within the United States in 2010 was an example climate activism in action (Skocpel, 2013).

Roser-Renouf *et al.* (2014) developed a theoretical socio-cognitive model which aims to explain the political activism for climate change mitigation, as demonstrated in Figure 3.9. It demonstrates that there are two key stages; initially it explains climate change impact and then how an individual value's something[35].

Climate activism has its roots embedded in environmental activism. The beginning of the 1990s was accompanied by the emergence of the first environment direct action groups within the United Kingdom (Bowers and Torrance, 2001; Doherty, Plows and Wall, 2007). The first group that formed was the UK Earth First!, which is a group that were founded in the late 1970s to the early 1980s. They are described as a radical environmental advocacy group (Jarboe, 2002). Earth First! has since expanded to nineteen countries[36].

It should be noted that the United Kingdom branch of Earth First! do not use anarchist tactics that the group within the United States have been using since 1990s. The reason for this difference was described by two of their founders as being due to "We knew EF! US's original hardline "rednecks for

[34] - See section 7.4 for further information about Extinction Rebellion

[35] - Also known as "world view"

[36] - The nineteen counties that Earth First! operate in are Australia, Belgium, Canada, Czech Republic, France, Germany, India, Italy, Mexico, the Netherlands, Nigeria, New Zealand, the Philippines, Poland, Republic of Ireland, Slovakia, Spain, the United Kingdom and the United States

wilderness" attitude wouldn't appeal here, so we set out to build a group that combined radical action and social justice to protect Britain's few remaining natural places” (Bowers and Torrance, 2001, Online).

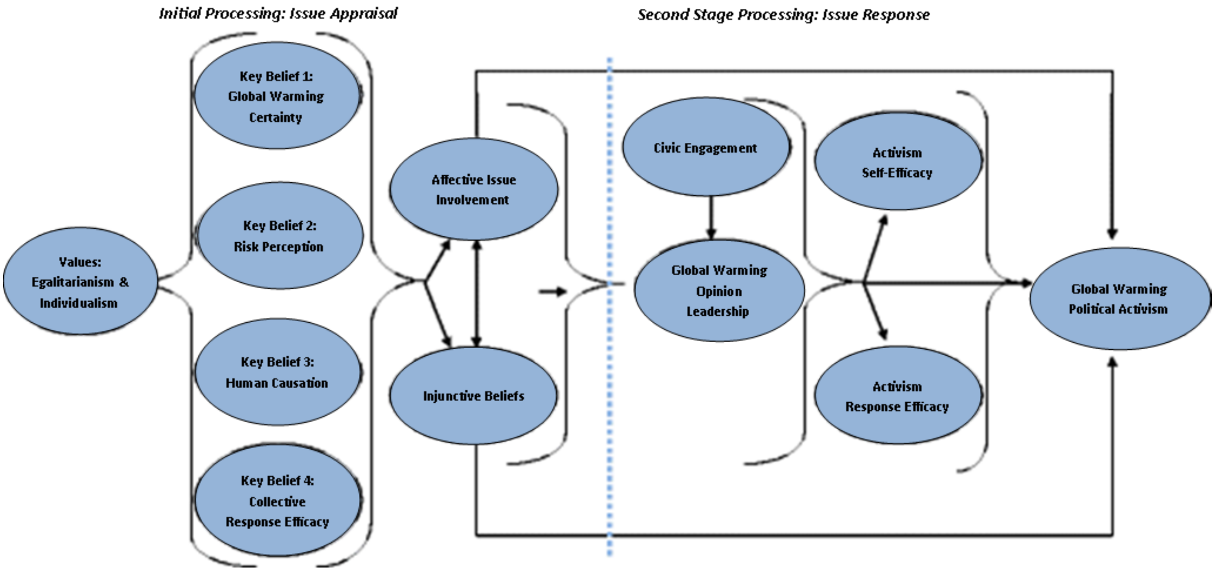


Figure 3.9 - Theoretical social-cognitive model of political activism for climate change mitigation (Source: Roser-Renouf et al., 2014, p. 165)

Until recently, the United Kingdom was known for its lack of social movements compared to its European counterparts (Rootes, 1992), but with a recent increase of protests surrounding the environmental issues, such as anti-road and fracking protests. Chris Rowe, who is the former head of Greenpeace, highlights in 1999 that within the United Kingdom, environmental activism was highly unusual. He stated that the biggest issue for Greenpeace in the United Kingdom is that:

> *“the use of direct action throws up many conundra and questions and difficulties to people as to whether or not they think this is a legitimate thing to do, that … becomes the issue sometimes instead of what it is they’re trying to campaign about ... (in) Germany … direct action, street theatre and street politics is seen as a completely legitimate form of political expression … whereas here (United Kingdom) it seems totally alien in this culture”.*
>
> Dryzek *et al.* (2003, p.46)

The most regular form of activism for climate change protesting within the United Kingdom is Earth Hour. This is an international event organised by the World Wide Fund for Nature (WWF). The event encourages individuals, communities, companies and local governments to switch off non-essential lights for one hour; to highlight climate change and to be a symbol of solidary to the planet. The event has its origins to Sydney, Australia in 2007 and occurs between 19:30 and 20:30 on the last Saturday of March; with the exception of when it clashes with Holy Saturday (Earth Hour, No Date). In 2017, it is estimated that 187 countries and territories observed Earth Hour (WWF, 2017). It was estimated by Olexsak and Meier (2014) that between 2007 and 2012, the electricity consumption within ten countries drops on average by four percent. But this varies, with New Zealand increasing its consumption by two percent and Canada decreasing its electricity consumption by 27 percent.

However, since 2018, the United Kingdom has seen the raise of activism in relation to climate change, with ‘Extinction Rebellion’ and the ‘School Strike for Climate Change’. Further research that examines public attitudes to these two groups activities are presented in Chapter 7 of this thesis. However, it is already apparent that both groups employ nonviolence protests to demonstrate their feeling towards climate change and get the attention of the media, politicians and civil society in general. The term “nonviolence” is difficult to define, with Johansen (2007) highlighting that it is used variously in different contexts. The most common method that these two groups have used is civil disobedience which broadly fits with the following list of attributes.

1. *A violation of a law or generally accepted norm*
2. *It is done without the use of violence*
3. *It is done in full openness*
4. *It is done with a serious commitment*

Johansen (2007, p. 150)

3.7. Youth Engagement

Lorenzoni, Nicholson-Cole and Whitmarsh (2007) refer to engaged people in this context as those who evaluate and respond to climate change through behavioural, cognitive and emotional engagement. As demonstrated in Section 3.2.1, within civil society, the level of engagement differs depending on different social groups, including across gender and political identification.

Stern (2000) highlights that there are four types of environmentally significant behaviour:

1. Environmental Activism
2. Non-activist Behaviours in the Public Sphere
3. Private-Sphere Environmentalism
4. Other Environmentally Significant Behaviours

In terms of youth engagement within the sustainable development context, it has been acknowledged by the United Nations General Assembly (2012, p.9) that there is great importance in young people’s engagement, as indicated with the following statement:

> *"We stress the importance of the active participation of young people in decision making processes as the issues we are addressing have a deep impact on present and future generations, and as the contribution of children and youth is vital to the achievement of sustainable development. We also recognize the need to promote intergenerational dialogue and solidarity by recognizing their views"*

It should be noted that the young are key stakeholders for climate change as they will face increasing risks due the effects of climate change in the future. Therefore, it is important that the youth are given the resources, knowledge and skills to further increase their adaptive capacity towards climatic threats (El Ansari and Stibbe, 2009; Nisbet, 2009). In addition, it has been reported by Olsen (2009) that climate change will have an impact on the job market in the future. Renner, Sweeney and Kubit (2008) highlights that there are four future ways that the job market will change within the future. Firstly, there will be a creation of new jobs, for example the manufacturing of pollution-control devices. Secondary, the replacement of jobs, for example the transition of working from landfill sites towards recycling plants. Thirdly, the elimination of some jobs. This has already been seen in the plastic bag industry after the five pence tax for every plastic bag in supermarkets. Lastly, this group will contain many workers and is an adaptive group, for example in engaging subtle changes in working practices.

Consequently, some researchers in recent years have created models that conceptualise potential ways to engage young people with modern societal issues, such as climate change. One method was created by Fletcher and Vavrus (2006) who developed the 'Cycle of Youth Engagement', which is demonstrated within Figure 3.10.

One of the main issues is trying to get young people to engage. Corner *et al.* (2015, p.530) highlighted that "young people do not necessarily see what they can do in response to climate change, and when perceived self-efficacy is limited, personal engagement with climate change is likely to be lower". Therefore, by using climate activism, it encourages young people to challenge the power relationship that they have with other adults, and put pressure on the government to legislate practices and behaviours that mitigate against and adapt to climate change (O'Brien and Selboe, 2015). This practice has been observed in 2019, with the protests by both 'Extinction Rebellion' and 'School Strikes for Climate' which have led to changes to the 2008 Climate Change Act, resulting in more ambitious targets.

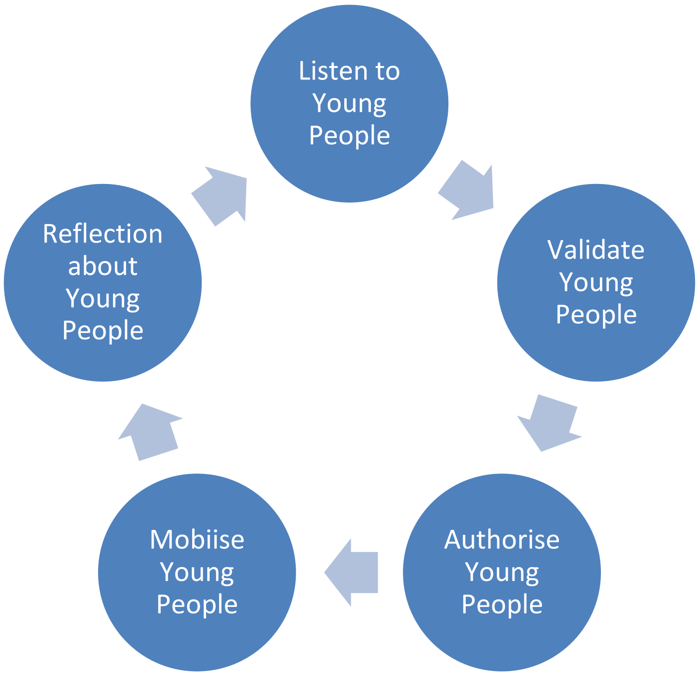


Figure 3.10 – Cycle of youth engagement (Adapted from Fletcher and Vavrus, 2006)

3.8. Literature Review Summary

It is demonstrated that the world's climate change has increased by 1°C since the start of the Industrial Revolution. This change is caused predominately by the release of myriad greenhouse gas emissions through anthropogenic activity. Currently, it is impossible to tell how high the temperature will rise by the end of the century, but it is targeted under the Paris Agreement to try to limit temperature increases to 1.5°C; but under business as usual, temperatures will rise by around 4°C. To meet these targets, each government including the regional and national government have varying mitigation strategies and targets to help the international effort.

However, without public support for legislation to mitigate climate change, little of the policy formulations will work. Whilst the majority of people are aware and concerned about climate change, there are others that have a miscomprehension on the causes of climate change, and a further few who are sceptical of climate change. The varying levels of perception are determined to be due to a number of factors, including an individual's world view, recent weather, the uncertainty of climate change, mistrust in science or communication of climate change and the terminology that an individual receives and uses to describe the recent changes in the climate. Whilst there has been research on the role of world view factors undertaken within the United States, this has not been fully developed in terms of youth engagement and little has been undertaken within the United Kingdom.

Climate scepticism can be observed within both the United Kingdom and the United States. There are think-tanks, including The Heartland Institute, which promote climate scepticism and denial. One of the most popular ways of these think tanks and their accomplices is to confuse civil society's understanding of climate change using arguments of 'natural processes' that have previously changed the climate. The methods have also been to try to undermine current science research through generating controversies, including 'Climategate'.

Two ways in which the public are taught about the science of climate change are through education and the media. The media and personal experiences can be viewed as supporting an informal education. Within the United Kingdom, formal education mostly limits the teaching of climate change to be within the geography subject area. The media is where the public gain most scientific information about current issues; it is therefore important for the scientific community to work with the media. Further, it is demonstrated that climate change reporting in tabloid newspapers are more likely to be unfavourable and can produce a negative emotive language against climate science and climate change mitigation. Also, the increasing myriad of media via satellite television or social media has resulted in the development of echo-chambers and fake news. Within this context it is important to acknowledge the increasing influences of celebrities in communicating climate change. All of the above raise questions as to how people within the United Kingdom are learning about and engaging with climate change.

In 2019, there has been an increase in climate activism within the United Kingdom via 'Extinction Rebellion' and 'School Strike for Climate'. However, environmental activism has been observed within the United Kingdom since the early 1990s. These groups in the most part use non-violent techniques, commonly akin to civil disobedience. However, as large-scale environmental activism until recently has been relatively uncommon within the United Kingdom, there is a need to understand why people within the United Kingdom are becoming increasingly supportive of these groups.

Lastly, the grounding in this topic presented by this review is highly consistent with a view that it is increasingly critical for youth to have an active role in addressing climate emergency. It is likely that the current generation of youth will be the last generation to live before a significant worsening of climate change impacts that are already underway. However, much more in depth analysis of the perception and engagement of the youth within wider society around the issues of climate change is needed to be able to understand the nature of these rapidly occurring processes of change.

3.9. Research Questions

To address some of the key gaps in research to date as justified from this review chapter, a number of research questions have been identified as follows:

- What influences perception of current and future adverse climate change impacts?
    - Are there certain demographic groups (such as Gender, Age, and Income) that are more likely to believe or reject climate change?
    - Are the public, particularly youth, influenced by different types of media (Printed, Television and Social) in terms of climate change?
- In what way, and how important is education in engaging the youth in climate change action?
- How do different factors influence the levels of engagement and disengagement towards adverse climate change impacts?
- How do extreme climate events affect an individual's views towards climate change during and in the immediate aftermath of the event?
- Why do UK youth and other parts of society become supportive of environmental activism, and likely to continue to participate in environmental activism?

3.10. Conceptual Framework

The purpose of this section is to explore the more consolidated conceptual framework that underpins this thesis, and that has been developed with the influence of the literature presented. The conceptual framework sets out different stages in the relationships of how people are engaging with climate change.

To clarify its role in this thesis, conceptual frameworks are used when a researcher wants to clarify, evaluate and integrate concepts, models and methodologies from previous research (Miles and Huberman, 1994; Robson, 2011). The conceptual framework is often derived from objectives in theory and is done prior to research being undertaken (Merriam and Simpson, 2000). The conceptual framework within this thesis, as shown in Figure 3.11, is a feedback loop which is demonstrating how perception, engagement with climate change and reaction and response to the risk of climate change are interlinked.

Figure 3.11 demonstrates that there could be four main factors that influence the overall perception of climate change. The first factor is an individual's world view. Existing research has demonstrated this trend. For example, individuals that are politically right-wing are less likely to believe in anthropogenic climate change compared to those who are left-wing voters (Krosnick *et al.*, 2006;

Dietz, Dan and Shwom, 2007; Dunlap and McCright, 2008; McCright and Dunlap, 2011; Weber and Stern, 2011; Guber, 2013; Hamilton *et al.*, 2015; McCright, Dunlap and Marquart-Pyatt, 2016; Leiserowitz *et al.*, 2019b). World views that influence an individual's climate change perception are relative to age (Reinhart, 2018; Ballew *et al.*, 2019b); gender (McCright, 2010; van der Linden, 2015); levels of education (Hamilton, 2011; van der Linden, 2015); ethnicity (Benegal, 2018; Elias *et al.*, 2019). In addition, some aspects of an individual's worldview [especially political identification] can influence media representations via television, traditional news and social media. This allows individuals to consume news that conforms to their own belief systems, otherwise known as residing in an echo-chamber (Walter, Brüggemann and Engesser, 2018). These echo-chambers are problematic, as they can lead individuals to "mistake the selected confirmative media content for public opinion" (Eilders and Porten-Cheé, 2016, p. 94). As a consequence, individuals can believe that "anthropogenic climate change is up for debate, when in fact outside of this echo chamber there is overwhelming evidence and scientific agreement about climate change" (Farrell, 2015, p. 720).

It is suggested that an individual's experience of extreme weather events can have a direct impact on the perception of climate change (Krosnick *et al.*, 2006; Lorenzoni and Pidgeon, 2006; Li, Johnson and Zaval, 2011; Bergquist, Nilsson and Schultz, 2019). This creates a feedback loop within the conceptual framework, but, experience can also come in the form of experimental learning which can come from education.

Education forms an important part of the perception of climate change, as it informs individuals about the basic sciences and risks that are associated with climate change. It has been raised as important enough for international organisations to have flagged this (UN 1992; UN, 1998; UNESCO, No Date). As climate change is a relevantly new concept, it has meant that a large proportion of the population [especially older] have not received any form of formal education about it. It is therefore important that non-formal education is enabling the scientific community to educate the public about the threats that climate change poses.

All of these factors have implications for individual perceptions of climate change. As demonstrated within Figure 3.11, an individual perception of climate change could influence the nature of engagement and reaction and responses to risk that an individual demonstrates. In most cases, those who are very concerned about climate change (perception) are more likely to engage and respond. However, in some cases, there are individuals who express extreme levels of a perception, experience or education related to climate change. In these cases, there is the potential to have a feeling of hopelessness overwhelmed by the information been given to them, which can lead to a disengagement (O'Neill and Nicholson-Cole, 2009), as they feel that they cannot do anything and/or it is too late. However, this thesis also considers that heightened experience, perception and education may have the effect of increasing actions on climate change.

Climate policy has commonly been used globally, especially within the United Kingdom, as a method to tackle climate change, either through mitigation and/or adaptation. This is an influential method, as it forces the civil society and businesses to change their behaviour towards reducing future impacts through reducing carbon emissions or adapting to the changes that future climate change will produce. Some of the examples of legislation within the United Kingdom to mitigate against climate change include the Climate Change Levy under the *Finance Act 2000*, *Climate Change and Sustainable Energy Act 2006*, and fuel price escalator [between 1993 and 1999]. However, it is not a linear process at this policy level, and the public have previously protested the perceived lack of action to bring forward or revise legislation. For example, it is argued here that the Extinction Rebellion protests in the centre of London in April 2020, resulted in a revising of the 2050 target set by the *Climate Change Act 2008* from 80 per cent to 100 per cent.

Climate Hazard is the overall background influence that weather can have on the atmosphere. This directly feeds into the 'magnitude and frequency of environmental change', though is a function of risk dependent on human vulnerability and exposure factors, these terms are introduced in the glossary. The nature of human engagement within this process determines the intensity and extent of the disaster impact outcome. A low level of engagement from civil society and organisations would, in general, tend to suggest that less mitigation of climate change would be undertaken, which in turn will result in a greater warming of the Earth's atmosphere and all the risks that entails.

As such, 'magnitude and frequency of environmental change' combines with the 'vulnerability and exposure' to create the 'intensity and extent of disaster impact outcomes'. Whilst increased intensity of the storms with increased exposure that civil society will experience leads to 'Intensity and Extent of Disaster Impact Outcomes' within this conceptual framework, adaptation measures reduce the extent of disaster outcomes upon civil society.

The impacts of extreme climatic events will result in two different impacts. The first is fed back to the 'reaction and response to risk'. This is because the civic societies that have been impacted want something to be undertaken to improve adaptation to the impact of these climatic hazards. This has been institutionally undertaken in recent years within regions that have been impacted by flooding, with the building of flood barriers [as seen in York] or the dredging of the rivers [as seen in the Somerset Levels]. But the impacts will form as a part of experience, which highlight to those that have been impacted the potential dangers and threats that climate change poses to themselves and their families, especially if the impact of climatic events are progressively becoming worse.

Secondly, those who have, or are more likely to believe that climate change is occurring due to anthropogenic activity, might have higher levels of engagement, but not in every case due to various psychological factors, such as fatalistic attitudes. These people are more likely to undertake mitigation strategies, such as reduction in the usage of private transportation, and buying insulation for the home, which will in turn contributes to reducing the magnitude and frequency of environmental change. In addition, this engagement could have an impact on the levels of vulnerability an individual faces. This is known as adaptation, which is Engagement whereby an individual undertakes to prepare for the elevated risks that climate change poses, which feedbacks to 'Intensity and Extent of Disaster Impact Outcomes'. Further societal reactions include pushing for greater advocacy in reducing climate change, including through non-violent direct action and civil disobedience, as returned to later in this thesis.

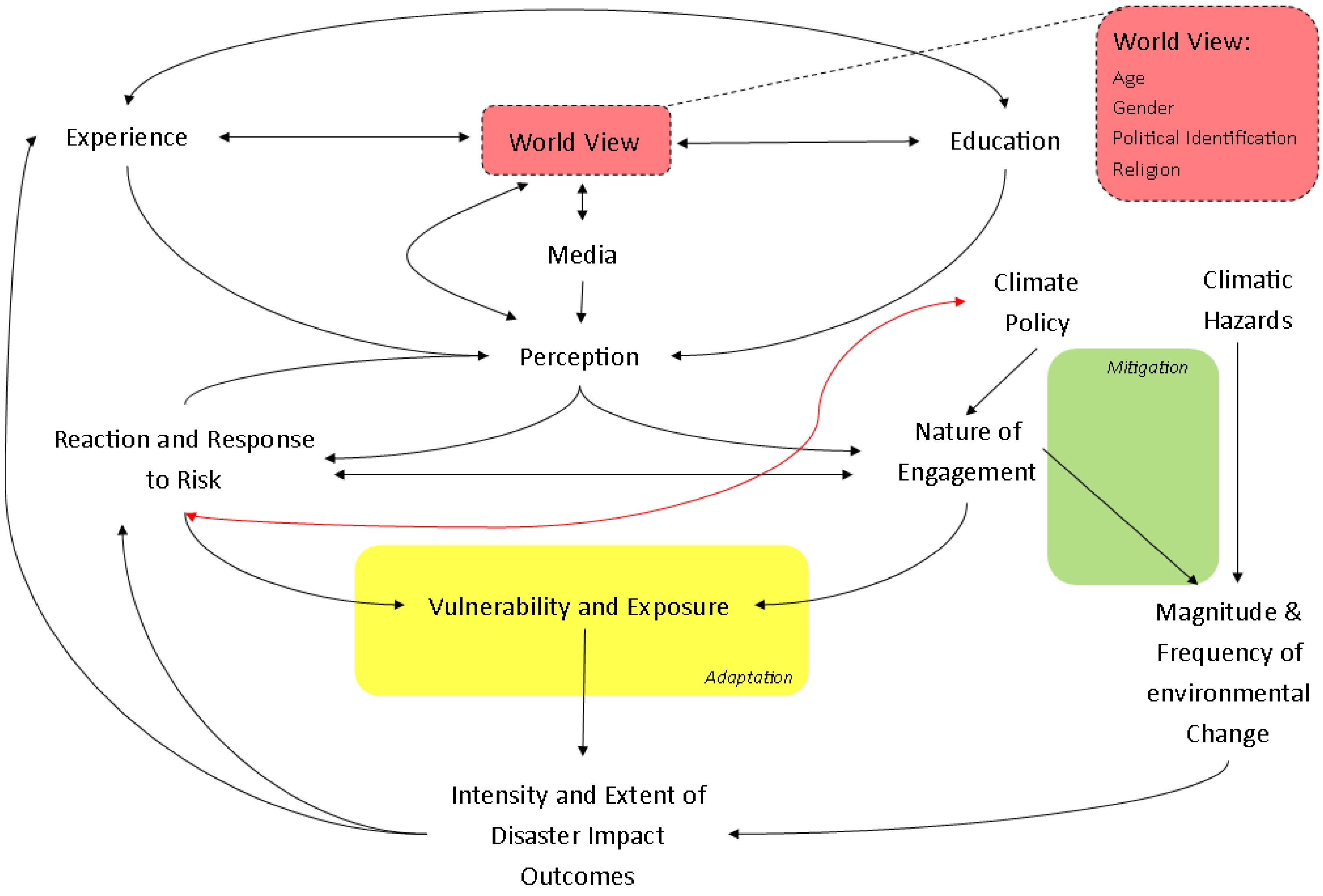


Figure 3.11 – Conceptual framework of climate change perception, engagement and response (Source: Author)

Chapter Four - Methodology

©Tom Reading (2014)

"We're running the most dangerous experiment in history right now, which is to see how much carbon dioxide the atmosphere … can handle before there is an environmental catastrophe"

Elon Musk in 2013)
CEO of SpaceX and Tesla, Inc.

Cite by Woodyard (2013, Online)

This research uses an inductive approach based on data derived through mixed methods, which was undertaken between March 2017 and July 2019. The varying methods included the use of two sets of questionnaires, interviews, Yonmenkaigi System Method and the use of secondary data analysis throughout. The secondary data sources include academic journals, research reports and market-based research. All data collected was analysed using statistical, observational and content analysis. Patterns observed are integrated and used to inform a theory of climate change perception, engagement and response amongst young people within the United Kingdom.

Figure 4.1 demonstrates the methodological mapping of this thesis including the different types of data and when it was collected. It also demonstrates how the varying research data feeds into the different chapters. In addition, it demonstrates how recent and current events influenced this thesis. In April 2019, there was a mass protest by both 'Extinction Rebellion' and the 'School Strike for Climate' movements. Consequently, it became fundamental to this research to capture this potential change in attitudes towards climate change, especially amongst young people. The COVID-19 pandemic also impacted during the latter part of this work and consideration of the learning for climate change perception, engagement and response during pandemic represents an emphasis of ongoing research drawing on this thesis.

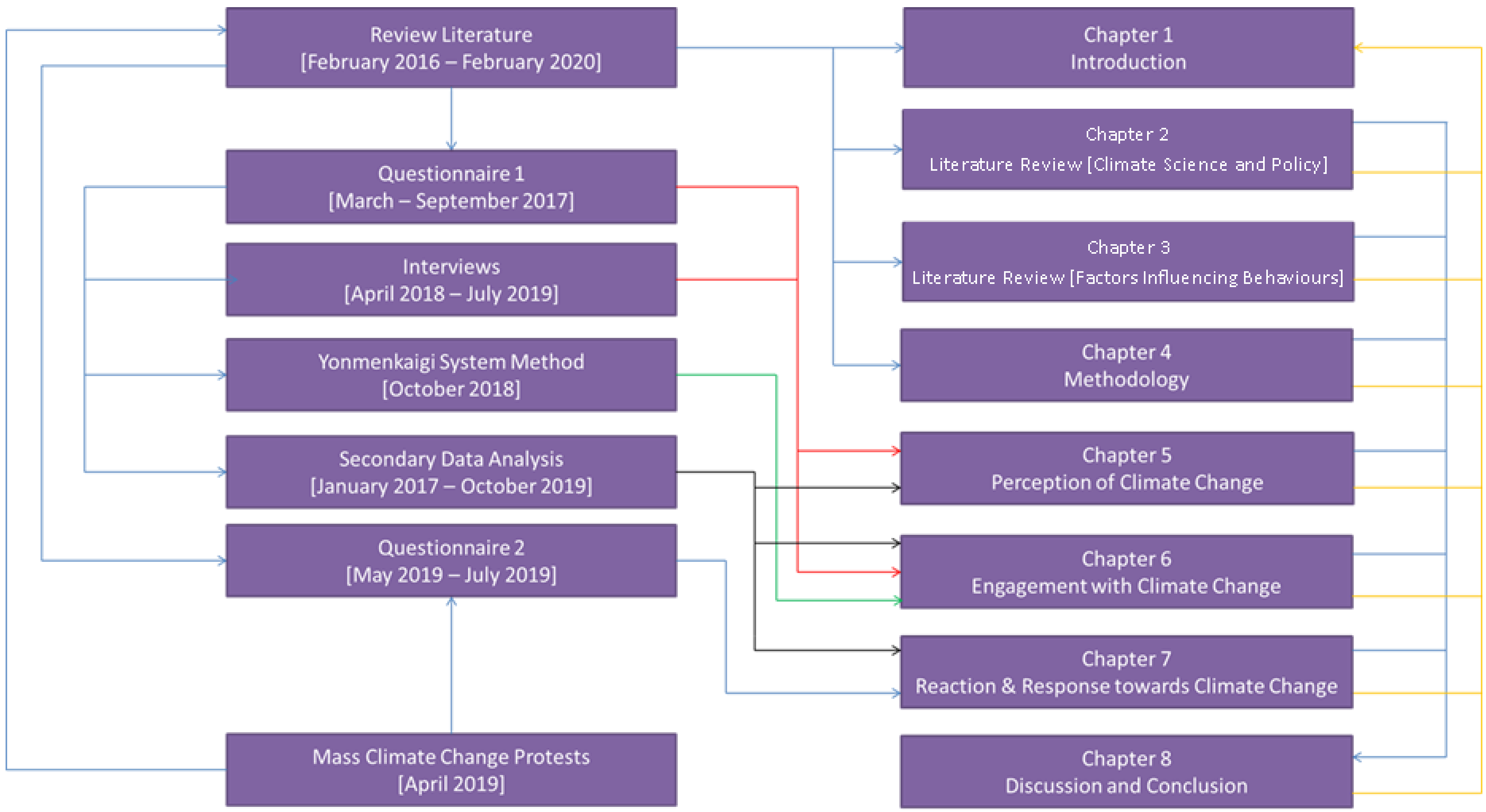


Figure 4.1 – Methodological map of this thesis (Source: Author)

4.1. Research Philosophy

Philosophy is defined by Teichman and Evans (1999, p.1) as "a study of problems which are ultimate, abstract and very general. The problems are concerned with the nature of existence, knowledge, morality, reason and human purpose". The philosophical basis of this thesis is based on the examinations of climate change in terms of the nature of societal engagement with it; how knowledge of climate change is taken up and what is done with this information.

Within social science, there are multiple research paradigms to choose from. These are broadly ontology [what do we believe?], epistemology [how do we know?], and axiology [what do we believe is true?] (Patton, 2002). This thesis examines the *knowledge* of climate change amongst British society; the thesis has used an epistemology defined by Scott (2015, Online) as the "philosophical theory of knowledge – of how we know what we know". This highlights that epistemology is interlinked with depth of knowledge. It should be noted, as highlighted in Figure 4.2 in the form of an Euler diagram there is knowledge as truth, belief and justification.

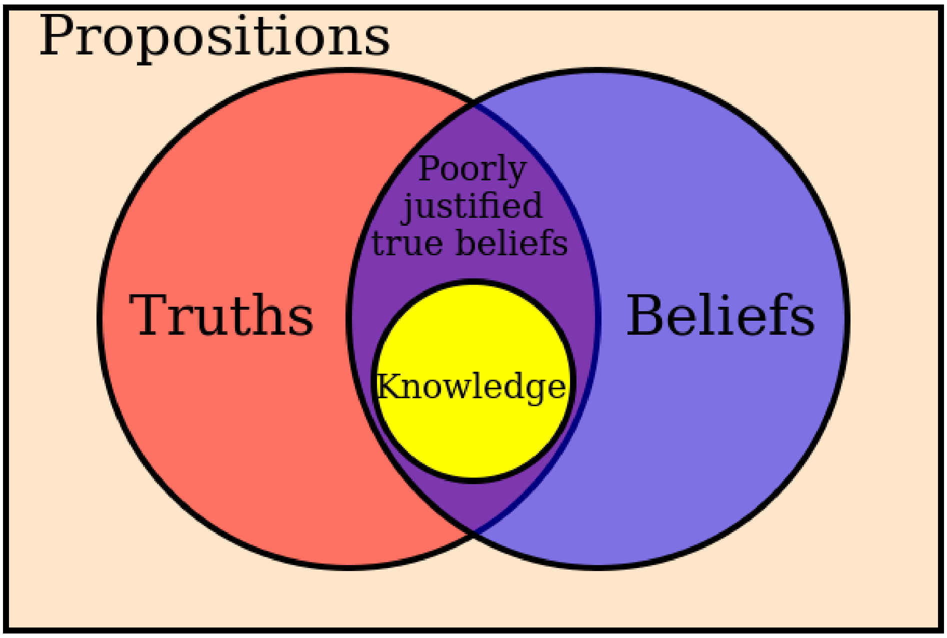


Figure 4.2 - Interlinkage between knowledge, truth, belief and justification (Source: Cline, 2019, Online)

Therefore, the previous definition of epistemology can further expand so that its states "all researchers, indeed all lay actors too, have sets of epistemological beliefs (of which) these beliefs are debatable" (Castree, Kitchin and Rogers, 2013, p.136). This highlights that people obtain their beliefs from different sources, which results in differing opinions. Example of these differing beliefs within the climate change realm can be observed within the United States between Democratic and Republican voters. This is demonstrated in a study by Leiserowitz *et al.* (2018) showing that 78 per cent of Democratic voters think global warming should be a high priority for the president and congress, compared to 25 per cent of Republican voters.

It should be noted that epistemologically, there are contrasting types of approaches to relevant research in this field that can be undertaken; positivism, interpretivism, and pragmatism. The differences between these are demonstrated within Table 4.1. Within this thesis, pragmatism was predominant due to the need to draw from varied sources and perspectives to understand the multidisciplinary realm represented by climate related issues. As demonstrated within Table 4.1, pragmatism is a research paradigm that allows the use of mixed-methods; which "focuses instead on 'what works' as the truth regarding the research questions under investigation" (Tashakkori and Teddlie 2003, p.713).

Table 4.1- Differences between research approaches

Research Approaches	Research Approach	Ontology	Axiology	Research Strategy
Positivism	Deductive	Objective	Value-free	Quantitative
Interpretivism	Inductive	Subjective	Biased	Qualitative
Pragmatism	Deductive or Inductive	Objective or Subjective	Biased or Value-free	Quantitative and/or Qualitative

Source: Wilson, 2010

As highlighted within Table 4.1, pragmatism research can either be objective or subjective depending on the research project. Objective research is "an ethic of impartiality in which a person analyses or judges things without bringing their own values, preferences, or prejudices to bear" (Castree, Kitchin and Rogers, 2013, p.352). This means that research within the context of this thesis should try not being either pro-climate change or pro-climate denial and should be an even-handed approach to the research, which is not always the case, as constructivist researchers would argue that researchers cannot be objective as individuals will always interpret the world through an unconscious lens. Whereas subjective leaning research contrasts with more objective approaches[37], there are with either pro-climate change or pro-climate denial arguments to be confronted throughout.

Within this thesis, an objective approach has been attempted, but it is recognised that much of the subject is a critical and emotive realm such that writings on climate change perception, engagement and response may never be fully objective. This is because as the author has an invested interest,

[37] - Subjective research tends to rely on person opinion and judgment; whereas, objective research is based upon observation and measurements.

feelings and opinions might unwittingly influence. This research is therefore closest to the pragmatist position. The research technique can therefore either be biased or value-free. Value-free is described by McLean (2011, p.316) as “research that has been produced by a completely impartial and dispassionate researcher. The proposition is that if a researcher can conduct a study shorn of his or her own particular beliefs, values, prejudices and opinions, this impartiality will presumably be reflected in the end product of the research”.

As a consequence of attempting to use an objective approach, this research has been personal value-free as possible. The author has attempted to not be biased by their perception and emotions to the subject; but see Section 1.7, for further information about the author’s positionality. As highlighted in the previous paragraph, it can be debated whether any social science research can be value-free, and this is highlighted by McLean (2011). This is because human perception is influenced by all major social science issues that people have come into contact with. This is especially the case with controversial intra-society debated issues, such as climate change, as demonstrated within section 3.1. The issues concerned here could be viewed as heightened with varying types of social science researchers, where they have a vested interest with the topic.

Traditionally, a pragmatism-based research approach can be viewed as the “philosophical partner” for a mixed methods approach (Denscombe, 2010, p. 148), as also demonstrated within Table 4.2.

This thesis triangulates the data that was needed. A triangulation approach is when more than two methods of data collection are used to gather data within the research to study a phenomenon or issue (Denzin, 2006; Casey and Murphy, 2009). Triangulation in research has its origins traceable back to the 1950s according to a study undertaken by Campbell and Fiske on the validity of psychosocial traits (Creswell, 2003). Triangulation approaches to data collection have been gaining popularity since the 1980s (Onwuegbuzie and Leech, 2005). Within the last fifteen to twenty years, there has also been a marked increase in the number of studies that have used mixed-methods (Brierley, 2017; Chapman *et al.,* 2017; Shuckburgh, Robison and Pidgeon, 2012).

The use of multiple approaches to collect data increases the validity of the data being collected. This is done by “increasing confidence in research data, creating innovative ways of understanding a phenomenon, revealing unique findings, challenging or integrating findings, and providing a clearer understanding of the problem” (Thurmond, 2001, p.254). However, Johnson, Onwuegbuzie and Turner (2007) highlight that instead of the three categories of quantitative, qualitative and mixed methods, there are five categories of methods, which highlight quantitative and qualitative dominated mixed methods. These different categories of methods are demonstrated within Figure 4.3.

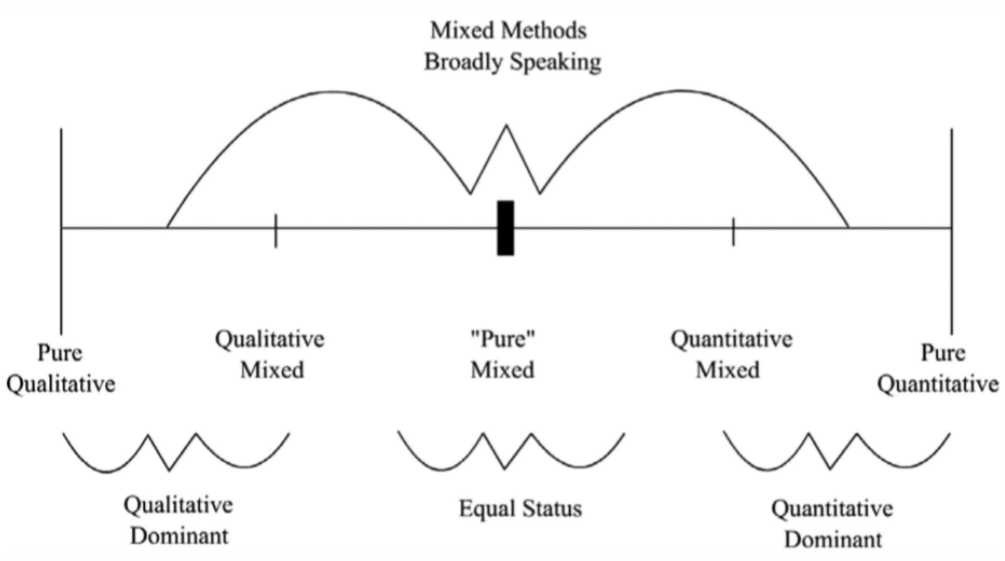


Figure 4.3 – The five subset categories of methods within research (Johnson, Onwuegbuzie and Turner, 2007 p.124)

It should be noted, that with all research methods, there are different strengths and weaknesses of using a mixed method approach. These are demonstrated within Table 4.2. It is demonstrated that there are significantly more benefits in using a mixed methods approach. The main advantage of using mixed methods is that it gives broader and more in-depth answers to the research questions with stronger evidence, as has been found through the process of this thesis. However, it was more expensive and time consuming due to the amount of time spent on setting up, undertaking and analysing data that was collected from the different methods that were used.

Whilst this thesis uses a mixed method approach, the definition of qualitative research and/or data is a challenge not least since this more comprehensive view of data extends to "a term for non-numerical information, including text, images, and sounds, including literature, diaries, policy documents, interview transcripts, photographs, art, video, films and music" (Castree, Kitching and Rogers, 2011, p.405). It should be noted that whilst quantitative data is used in this thesis, the qualitative is the collection of data that focuses on the quality of research rather than quantification. Whilst overall one is not better than the other, they have different functions and are fit for different purposes. The research therefore allowed for the researcher to examine the research topic in greater detail and more openly to provide a potential explanation for research themes (Denzin and Lincoln, 2000).

Table 4.2 - Strengths and Weaknesses of a Mixed Method Approach

Strengths	Weaknesses
• Words, pictures, and narrative can be used to add meaning to numbers • Numbers can be used to add precision to words, pictures, and narrative • Can provide quantitative and qualitative research strengths • Researcher can generate and test a grounded theory • Can answer a broader and more complete range of research questions because the researcher is not confined to a single method or approach • A research uses the strengths of an additional method to overcome the weaknesses in another method by using both in a research study • Can provide stronger evidence for a conclusion through convergence and corroboration of findings • Can add insights and understanding that might be missed when only a single method is used • Can be used to increase the generalizability of the results • Qualitative and quantitative research used tightly together produces more complete knowledge necessary to inform theory and practice.	• Can be difficult for a single researcher to carry out both qualitative and quantitative research, especially if two or more approaches are expected to be used concurrently; it may require a research team • Researcher has to learn about multiple methods and approaches and understand how to mix them appropriately • Methodological purists contend that one should always work within either a qualitative or a quantitative paradigm • More expensive • More time consuming • Some of the details of mixed research remain methodologically complex (e.g., problems of paradigm mixing, how to qualitatively analyse quantitative data, how to interpret conflicting results)

Source: Adapted from Johnson and Onwuegbuzie (2004)

Nonetheless, within this overall methodology, quantitative research and/or data are defined as "a term for numeric information and its use in systematic inquiry" (Castree, Kitching and Rogers, 2011, p.405). Therefore, it should be noted that as the data is numerical, it allows a larger amount of data to be progressed/analysed in a short period of time. However, it only gives a small snapshot of what might be happening.

Further examples of how previous studies have approached climate change perception and engagement of civil society within the United Kingdom are demonstrated within Appendix A. In addition, Appendix B demonstrates the same, but for international studies. Each study listed demonstrates whether they are using quantitative (survey), qualitative (focus group/interviews) or a mixed method approach.

Lastly, there are a number of different approaches towards data analyses, but the most common two are inductive and deductive. Since an inductive approach to analysing the data was used, this is qualified as a recursive research, as defined by Castree, Kitchin and Rogers (2011, p.96); "a form of reasoning from which general conclusions are drawn from the observations of a single class or combination of phenomena". The fundamental reasoning in the use of this approach is in that it allows generalisation of the findings of the research. For example, if X per cent of young people within the sample believed that climate change was caused by anthropogenic climate change, then it can be assumed that X per cent of young people within the population may believe that climate change was caused by anthropogenic climate change. In addition, it also allows theories to be put forward as to why trends are observed within the quantitative data, with the help of the qualitative data.

4.1.1. Overall Thesis Methodology in Relation to the Objectives

Five objectives emerged around research questions tackled in this research process. Table 4.3, outlines the different research questions, research methods, sampling approach for each method and characterisation of the participants.

Table 4.3 - Use of research questions

Research Questions	Research Methods	Sampling Approach	Research Participants
What influences perception of current and future adverse climate change impacts?	Questionnaire	Random	Civil Society
	Secondary Data Analysis	N/A	N/A
In what way, and how important is education in engaging the youth in climate change?	Questionnaire	Random	Civil Society
	Interview	Selective	Questionnaire Participants
	Content Analysis	N/A	N/A
	Yonmenkaigi System Method	Selective	First Year BSc Students
How do different factors influence the levels of engagement and disengagement towards adverse climate change impacts?	Questionnaire	Random	Civil Society
	Secondary Data Analysis	N/A	N/A
	Interviews	Selective	Questionnaire Participants
Why do UK youth and other parts of society become supportive of environmental activism? In addition, in what way are UK youth and other parts of society likely to continue to participate in environmental activism?	Questionnaire	Random	Civil Society
How do extreme climate events affect an individual's views towards climate change during and in the immediate aftermath of the event?	Questionnaire	Random	Civil Society
	Secondary Data Analysis	N/A	N/A
	Interview	Selective	Questionnaire Participants

Source: Author

4.2. Questionnaires

A questionnaire, as applied in this research, is a research method that uses a group or sequence of questions that are designed to collect information about one or more topics from respondents (Dodge, 2003). Survey questionnaires are regularly used with social science research, and have extensively been used previously to examine perception and engagement with climate change globally, such as in the research by Whitmarsh (2009); Whitmarsh (2011); Poortinga *et al.*, 2013; Asekun-Olarinmoye *et* *al.*, 2014; Shi,Visschers and Siegrist, 2015; Kabir *et al.*, 2016; Chan et al. (2017); Li *et al.*, 2017; MartÍnez, Piña and Moreno (2018); Douenne and Fabre (2020)[38].

When designing a questionnaire, there is the option to choose between either an open or closed question for each question. Most climate change perception and engagement research has tended to apply the closed question approach. However, for both questionnaires designed and applied within this thesis, a mixture of both types of question were used. A closed question gives the respondents a limited response by giving them different opinions to choose from (Foody, 1993). In this thesis this allowed the general threads overall and between the different socio groups to be determined. Open questions allowed the respondent to respond to the question more freely, therefore not being influenced by the researcher (Foody, 1993). However, open questions are more difficult to analyse than closed questions (Schuman and Presser, 1996). Open questions were important in this thesis, as they helped to inform the author of why choices were made in the closed questions and to help theories of causality to be identified in relation to the trends observed. Interviews have been used for this process, but open questions have been prioritised, as questionnaires allow the researcher to collect data from more people in a shorter timeframe compared with interviews (Babbie, 2013).

It was important to determine questionnaire format; whether online, face to face or a mix of both. In recent years, the usage of electronic questionnaires within academic research has continued to increase, as already flagged for over a decade (Jansen, Corley and Jansen, 1996; Van Selm and Jankowski, 2006; Dolniclar, Laesser and Matus, 2009). The major benefit of electronic questionnaires is that they are cost effective. Whilst conducting research, Mavis and Brocato (1998) found that paper questionnaires can be seven times more expensive than electronic questionnaires. This can be attributed to the labour hours that are required to collect the data and materials used (Mavis and Brocato, 1998; Kaplowitz, Hadlock and Levine, 2004). However, electronic questionnaires have some negatives. Wiersma (2011) believes that low response rates are an issue; with a study by Murphy *et al.* (2020) who had an average response rate from email surveys of 4.5 per cent. This compares to Cook, Heath and Thompson (2000) who highlighting an average response rate from email surveys of 39.6 per cent. Research has demonstrated that in the last couple of decades, the response rates from email surveys have been declining (Sheehan, 2001; Shannon and Bradshaw, 2002; Fan and Yan, 2010; Roberts and Allen, 2015; Fosnacht *et al.,* 2017). In addition, it has been suggested by Scott *et al*. (2011) that a lack of trust from the respondents in sending information about themselves over the internet to an unknown source is why internet questionnaires get a lower response rate than paper.

[38] - Further examples are given in Appendix A and Appendix B

It is demonstrated by the ONS (2015) study that only 14 per cent of households within the United Kingdom do not have access to the internet. This is an increase from 2006, when the figure was 43 per cent. This demonstrates that more people use the internet for their everyday activities. In addition, it was observed that for households that only have one or more adults over the age of 65, this figure increases to 51 per cent. This demonstrates that more people are using the internet, but that the majority of people over the age of 65 still do have access to the internet. The study attributes this to cost and lack of skills. Therefore, it was originally determined that traditional paper-based questionnaires are still needed to be undertaken, as there is a high proportion of elderly adults that are still not connected to the internet.

Within this thesis, two main questionnaires have been used. The first questionnaire collection occurred between March and September 2017, and this was undertaken to gain an overview of the civil societal, especially young people's, perception and levels of engagement with climate change. Overall, 1,134 questionnaires were completed by the members of the public. The second questionnaire collection occurred between May and July 2019, and this was undertaken to gain an overview of the civil societal, especially young people's thoughts on both 'Extinction Rebellion' and 'School Strike for Climate' protests. Overall, 1,700 questionnaires were completed by members of the public for this second survey. Information about the socio demographics of the respondents can be found in section 4.2.6 and Appendix R of this thesis.

It should also be noted that both online and paper questionnaires were used within this survey. The reason why electronic questionnaire were used in this research is that they were proving to be more efficient in terms of time and expenditure in gathering results from around the country. However, after the first questionnaire, it was determined that for the second questionnaire, it was not necessary, as the response within the first questionnaire from the oldest in civil society was high enough using the online survey to provide sufficient comparisons between the different age groups.

In addition to these two main questionnaires, a smaller questionnaire was undertaken in October 2018, during the Yonmenkaigi System Method exercise, which is one of the techniques used to examine group engagement with climate change. The purpose of the questionnaire was to see if there was a change in relation to perception during the engagement experiment with students; to determine how successful this learning technique has been amongst youth. Overall, sixteen respondents responded to the questionnaires during the Yonmenkaigi System Method experiments.

Lastly, it should be noted that within both questionnaires, some questions are either based on or use the same questions from previous studies. This was done to be able to compare studies, as wording can alter the response of the answers given. Further details on the psychology influencing opinions are provided in Section 3.2. Table 4.4 provides a list of questions that have been taken from different studies and strategically included within this study.

Table 4.4 – List of Questions that have been borrowed from other studies

Question Number		**Question**	**Study**
Questionnaire 1	**Questionnaire 2**		
3	1	Do you believe that the world's climate is changing?	Capstick *et al.* (2015)
4	2	What do you believe is the cause of this change?	Capstick *et al.* (2015)
12	N/A	What do you think is the percentage of climate scientists that believe humans are causing climate change/global warming?	Leiserowitz *et al.* (2011)

Source: Author

4.2.1. Design

As previously stated, there have been two main questionnaires that have been conducted with two different purposes. The following two sub-subsections will explore how these questionnaires were designed with reference to the literature and conceptual framework, and how they link with the forthcoming results chapters.

4.2.1.1. Questionnaire 1

The main aim of this questionnaire is to gather an overview of both perception of and engagement with climate change from the civil society in both the United Kingdom and the Crown Dependences. Due to the wide range of questions these two themes can generate, this questionnaire was split into seven different sections, with each focusing on a different aspect, as demonstrated in Appendix S.

The first section was called "Climate Change", which consists of thirteen questions, and is to gain general overall background of the respondents about their perception of past, current and future climate change. It also explores how respondents rate different global threats and environmental issues in relation to climate change. Lastly, the section examines who the respondents trust in relation to communications about the science and impacts of climate change. This section is important, as it provides background information about climate change and the overall perception of the issue. This is needed, as highlighted within the conceptual framework of chapter three, as an individual perception of climate change plays a fundamental role in whether or not people engage with the issue of climate change, and if they do, to what extent. Therefore, all findings of this section are included within chapter five of this thesis and are used to build a picture about the general perception of climate change within the United Kingdom and how different socio-economic groups compare.

The second section was labelled "Climate Change and Education", consisting of only five questions, to determine how many of the respondents have been educated about climate change in the formal education setting. In addition, this asked to what level respondents were taught about climate change, what level should students be taught at and whether the public should be offered free workshops about the effects of climate change. Lastly, the respondents were asked about what they were taught at school, college and university. This is to see if any misconceptions were taught about climate change at school, an issue demonstrated in Section 3.4 of this thesis. The rationale is that education about climate change has been recognised by the United Nations for its importance in relation to forming young people's perception of climate change. This importance of education is further demonstrated within the conceptual framework of Figure 3.10. The questionnaire section was included so as to gather information about civil societal receipt of any formal education about the background and effects that climate change will have on the planet, and whether they feel it is important.

The third section was called "Climate Change and You", consisting of seven questions, and the purpose of which was to examine how the respondents have personally been affected by extreme climatic events. The first four questions examine the number of respondents that have been affected by extreme weather, its type, if affected and who else had been affected by these extreme weather events. In the following question, the respondents were given a list of nineteen different climate mitigation techniques and were asked which they had undertaken in the previous three years. The final two questions focused on how many and what type of environmental organisation the respondents were members of. These questions have been included to gather a mix of quantitative and qualitative feelings and attitudes towards this personal attachment towards slow-onset disaster.

The fourth section was called "Climate Change Policy", which consists of seven questions, and the purpose of this section was to examine how the respondents felt about climate change policy and the overall role of the current government in responding to climate change. This was done by asking four simple questions about how supportive they were of current environmental policy within the United Kingdom. The policies covered greenhouse gas reductions, fuel duty and road tax. Then a question was asked about what they were about, and which electricity supply should the United Kingdom be using. Lastly, they were asked to rate the British Government's handling of climate change on a scale of one to five, and how the United Kingdom can improve in the future. These questions are important as without the support of civil society, policies are likely to be changed deviating away from the original goals. These are especially important when the majority of policies relating to climate change and the environment can require a degree of financial investment, for example taxes, which are regressive and have a greater impact on low-income individuals (Dorfman, 1977; Johnson, McKay and Smith, 1990; Poterba, 1991; Jorgenson, Slenick and Wilcoxen, 1992; Poterba, 1993; Hamilton and Cameron, 1994; Cornwell and Creedy, 1996; Speck, 1999; Baranzini, Goldemberg and Speck, 2000; Metcalfe, 2009; Gough *et al.,* 2012; Dorban *et al.,* 2019; Wang and Matsumoto, 2021), who are disproportionately young people.

The fifth section was called "Media and Climate Change", which consists of eleven questions, and the purpose of this section was to examine the role of the media and climate change. The first four questions were asking the respondents which traditional media they engaged with and how often each week. Then they were asked to create newspaper headlines about climate change. This was to see what type of images, emotions and language respondent's use when answering the question. In the following three questions, the respondents are asked about their usage of social media and whether they use it to collect information about climate change. This is important as there is a growing media to provide information to the public about climate change. The final three questions of this section were to examine the respondent's opinions about the media's reporting of climate change. As highlighted earlier, media is the main source in which civil society gains its understanding of climate change; it is important to understand whether the message is being elucidated. This is especially important given the rise of social media alongside widely perceived or real increases in misinformation and fake news.

The sixth section was called "Demographic Data", which consists of ten questions, the purpose of these questions being to cross compare this data with the questions in sections one, three and four. The types of questions that were asked within this questionnaire were also quite similar to the demographic questions asked in the 2011 Census. Further details about the demographics of the survey are included with the results In Section 4.2.6.

The final section was called "Further Information", which consists of two questions. The purpose of this section was to ask the respondents of the questionnaires if they were willing to answer further questions in the form of an interview or through the Yonmenkaigi System Method. The idea behind this was to further explore themes that arose from the questionnaire. Respondents were also asked whether they wanted a copy of the findings. There are two main reasons why this option was given. Firstly, it was to allow the respondents to know how other people view climate change against their own beliefs, and secondly as common courtesy, as they have invested time within the study by participating.

4.2.1.2. Questionnaire 2

As highlighted in the methodological map in Figure 4.1, the second questionnaire was undertaken in the aftermath of the outbreak of the mass protests by both ‘Extinction Rebellion’ and ‘School Strike for Climate Change’. The main aim of this chapter is to determine the civil society’s perception towards these protests, which can be viewed as response to real or perceived inaction in combatting climate change. The questionnaire was only split into three sections, containing fifteen overarching questions, which contain four further sub-questions, as seen in Appendix T.

The first section is the main section within this questionnaire, starting with the background belief in climate change, using questions that appeared within the first questionnaire. These are then explored in relation to public opinion of Extinction Rebellion and whether they are supportive of their actions and causes. After this, the questionnaire asks similar questions, but this time focusing on the School Strikes for Climate Change. In between these two blocks of questions, the respondents were asked about whether they would join an Extinction Rebellion protest. This question is important as it will start to determine the number of people who could be exhibiting signs of moving towards post-normal engagement of climate change.

The final two sections of this questionnaire are similar to the first questionnaire in 2017, with questions based upon socio-demographic and whether the participant wants a copy of the findings.

4.2.2. Pilot Study

Within a social science context, a pilot study has two different meanings. The first is a feasibility study, which is a small run undertaken in preparation for a major study (Polit, Back and Hungler, 2001). The second is the testing of the research instruments, for example the suitability of the questions within the questionnaire (Baker, 1994).

There are numerous benefits of using a pilot study. Firstly, it allows the researcher to check whether the respondents are able to understand terminology within the questionnaire (van Telijinger and Hundley, 2001). For example, within this thesis members of the public might not be able to understand climate jargon like “anthropogenic” but are more likely to understand “human made”. Whilst pilot studies do not always guarantee that a research project will be successful, they can significantly increase the likelihood (Simon and Goes, 2011).

Before every questionnaire was set, a pilot study was undertaken making sure the questions were not going to be misinterpreted or confusing to the public.

Hertzog (2008) highlighted that there is very little literature on a suitable sample size for a pilot study. In addition, different studies tend to have various sizes of pilot, the highest being by Lackey and Wingate (1998) who used 10 per cent of the overall sample size; compared to Nieswiadomy (2002) who used 10 participants. For each pilot study within this thesis, a sample size of 10 participants was applied. Also, all data gathered within the pilot study was not used within the final findings of this thesis, as some wordings of questions were altered subsequent to the pilot. It was nonetheless also noted that other researchers, such as Leon, Davis and Kraemar (2011), had also recommended the approach of not using pilot study data in the main study.

4.2.3. Pre-Notification

Pre-notification of the respondents is where an initial contact between the researcher and the participant takes place, which can happen via a formal letter, email, telephone call or personal contact (Kent and Turner, 2002). For this research, pre-notification was only used for the questionnaires used within the Yonmenkaigi System Method. As the wider studies had to collect a large number of questionnaires, pre-notification would have been a time consuming and logistically an impractical process, and using forums and social media to spread the questionnaire, it would not have been possible.

The rationale behind pre-notification is that if the respondent knows about the study and the researcher, they are more likely to complete the survey (Duncan, 1979). However, research conducted in social and medical science fields has highlighted a potential mixture of the effectiveness of pre-notification. Some studies that have shown an increase in response rates (Fox, Crask and Kim, 1988; Yammarine, Skinner and Childres, 1991; Hembroff *et al.*, 2005; Link and Mokdad, 2005; Dykema *et al.*, 2011; Koitsalu *et al.*, 2018), some made no difference (Heberlein and Baumgartner, 1978; Wright, 1995; Hammink, Giesen and Wensing, 2010; Koopman *et al.*, 2013) and others showed a decline (Jobber and Sanderson, 1983). Overall, more studies seem to point towards a small but significant increase with pre-notification.

4.2.4. Coding

Coding is an analytical process in which both qualitative (for example, interviews) and quantitative (for example, questionnaires) are categorized to allow analysis to be undertaken (Fielding, 2015). As stated by Silvey (1975, p.16) "research ultimately must be based on comparisons", therefore coding responses allows data to be gathered quicker and in a more useable form, which allows it to be analysed and contrasted easier (Wilkinson and Birmingham, 2003).

Within this thesis, the two questionnaires contain both the two types of data; qualitative and quantitative. Google Forms was used for the collection of the online questionnaires. It automatically puts all responses into a spreadsheet, which can be opened on Microsoft Excel. All the qualitative data contains the response given in written form, which does not provide useful information. Consequence, each column of data is coded with a number in relation to the response given. This allows the data to be analysed on SPSS. For all the qualitative data, these were sorted into the responses based upon the question. All were put into a Microsoft Word document and were inserted into NVivo as a suitable qualitative data analysis software. For the paper-based questionnaire, these were however individually typed based on the author's coding.

4.2.5. Response Bias

The term "Response Bias" is defined as a cognitive bias that occurs during responding to a survey that affects the responses provided (Hurley, 1998; Villar, 2008). Furnham (1986) argues that response bias has major implications on the data output and therefore researchers need to take steps to either mitigate or reduce response bias within questionnaires.

There are several different types of response bias, such as for example 'extreme responding', 'social desirability bias' and 'demand characteristics'. Each of these response biases have been explored as follows in this section.

Extreme responding biases [ERB] are when respondents' only choses the most extreme options or answers available (Meisenberg and Williams, 2008). ERB was first investigated in the 1950s (Berg, 1953); however its effects are commonly ignored by researchers (Paulhus, 1991). ERB is particularly common when using a Likert scale (Kieruj and Moors, 2010); but some respondents are likely to only respond with the extreme numbers on the scale. For example, using a 1 to 5 scale, these respondents are likely to only use 1 or 5 for all answers.

Social desirability biases are when the respondent denies undesirable beliefs or qualities, to conform to more socially desirable ideologies (Nederhof, 1985). This usually is derived from the respondent's lack of comfort to reveal their true attitudes (Groves *et al*., 2009); this is also known as 'impression management' (Holtgraves, 2004; Uziel, 2010).

Demand characteristics in social science research are when a participant forms an interpretation of the experiment's purpose and therefore changes their beliefs and/or behaviour to conform to this interpretation (Lammers and Badia, 2005).

To reduce some of these biases, several different approaches have been undertaken within this thesis. The first is to be careful with the wording of a question, especially in avoiding a leading question and in relation to the length of a question (Lavrakas, 2008). This is thought to have reduced ERB. Another method that should have reduced the likelihood of ERB was through changing the format of the question quite often, for example, making sure all Likert Scale questions are not presented together.

It needs to nonetheless be acknowledged that no questionnaire design is going to get rid of all bias. The steps taken represent awareness of approaches that are needed in attempting to reduce these biases.

4.2.6. Sampling Approach and Self-selection Bias

Within this thesis, the sampling approach for both questionnaires was to post the surveys onto local community groups on the social media platform Facebook; an example of these local community groups used within this thesis is "Isle of Man, advice, help & local events". The predominant reason why social media sites such as Facebook were used is due to the large proportion of the United Kingdom population who use the site regularly, thus widening the scope of potential responses. This is illustrated by data gathered from the ONS (2020) which suggests that in 2020, roughly 70 per cent of the United Kingdom population have used one of these sites within the last three months of being surveyed. However, this approach raised the potential for self-selection bias.

Withing surveying, self-selection is defined by Bethlehem (2010, p.162) as where "it is completely left to individuals to select themselves for the survey". They go further into detail but in the case of web-based surveys, such as the case of the questionnaires within this thesis, a survey is simply put on a website; meaning that the respondents must be able to access the Internet, visit the site in which it has been posted on, and then decide that they wish to spare time in participating within the survey (Bethlehem, 2010). Consequently, the researcher does not have any control of the selection on who is accessing and participating within the survey.

To reduce the potential impacts at self-selection bias could have had on both the surveys within this thesis, the social demographic data was regularly monitored throughout. In the case that the researcher discerned that there was an underrepresentation of a certain social demographic group, the researcher would attempt to seek out people from these underrepresented groups via the use of targeted emails to certain public body organisations. In addition, paper surveys were conducted during the first survey, with a predominant aim to further target underrepresented socio-demographic groups. The sampling was also intuitive on the basis of collecting sufficient responses to reach a saturation point of new information, whereby it would not be cost effective in the context of this scale of PhD research to simply increase numbers of respondents even further amongst an already large number replies.

4.2.7. Socio-Demographic Breakdown

Within this research, two different questionnaires were undertaken to answer the questions set out earlier in this thesis. As highlighted through Chapter Three of this thesis, there are socio-demographic factors that can have an influence on a person's attitude towards climate change. Therefore, this section addresses the proportionality of respondents within the two questionnaires compared to their respective population proportionality.

4.2.7.1. Gender

As highlighted within Section 3.2.1.2, there are gender differences in response to climate change. This has been included in the work for this thesis albeit exposing also the further research needed to examine this in full.

According to the latest United Kingdom statistics of the overall population in 2015, it is estimated that 50.7 per cent of the British population are female, whereas, 49.3 per cent are male (ONS, 2016). It should be noted that within the survey for this thesis, a third option was available to represent people who are an intersex or transsexual. This option to indicate this was included within the questionnaire as there is a significant population that do not label themselves either 'female' or 'male'. This is demonstrated in a study by Reed *et al.* (2009) who estimated that the United Kingdom might have 56,000 transsexuals, which represents roughly 0.1 per cent of the population.

As shown in Table 4.5, of the 1,134 individuals who responded to the first questionnaire, 39.5 per cent were female and 59.7 per cent were males. In addition, it indicates that 0.2 per cent of the respondents identify themselves as other. Within this questionnaire, only 7 [0.6 per cent] refused to disclose their gender. This compares to the second questionnaire, as shown in Table 4.6, where 57.7 per cent were female and 41.2 per cent were male.

Table 4.5 – First Questionnaire Respondent's Gender

Respondent's Gender	**Number of Respondents**	**Percentage**	
Female	**448**	39.5%	39.8%
Male	**677**	59.7%	60.1%
Other	**2**	0.2%	0.2%
Refused	**7**	0.6%	
Total	**1,134**	**100.0%**	

Note: All Percentages might not add up to 100 per cent due to rounding errors

Source: Author

Regards the difference between male and female respondents between the two questionnaires attention is drawn to a literature on who are mostly likely to complete online surveys, a question that is still being debated. Some researchers have found that males are more likely to fill in questionnaires (Stanton and Rogelberg, 2001; McDonald and Adam, 2003; McCabe *et al.*, 2006), whilst other researchers have found the opposite (Sax *et al.*, 2003; Saleh and Bista, 2017). Therefore, it is not possible to determine why these differences occurred for these particular questionnaires.

Table 4.6 – Second Questionnaire Respondent's Gender

Respondent's Gender	**Number of Respondents**	**Percentage**	
Female	**981**	57.7%	58.2%
Male	**700**	41.2%	41.5%
Other	**4**	0.2%	0.2%
Refused	**15**	0.9%	
Total	**1,700**	**100.0%**	

Note: All Percentages might not add up to 100 per cent due to rounding errors

Source: Author

4.2.7.2. Age

According to the latest United Kingdom statistics estimating the population age in 2015, it is estimated that 22.6 per cent of the United Kingdom population are over the age of 65; whilst the 45 to 54 age group represent 17.9 per cent; 25 to 34 represent 17.2 per cent; 35 to 44 represent 16.3 per cent; 55 to 64 represent 14.5 per cent; and 11.5 per cent are between the age of 18 and 24 (ONS, 2016). It should be noted that these percentages do not represent people under the age 18 and also do not include people who live in the Crown Dependencies.

Table 4.7 illustrates the age categories of the individual respondents to the first questionnaire survey. The highest respondent age range were the over 65s at 26.6 per cent, which is above the national proportion of over 65s. One possible reason is that the majority of people over the age of 65 are likely to be either semi-retired or fully-retired, and therefore they have more time to respond to the questionnaire. It should also be noted that the age group "18-24" also provided responses above the national proportion; this is because this age group was specifically a focal aspect of the topic being examined - their attention was brought to it more. it was necessary that this group of respondents would be sufficiently high.

Table 4.7 - The First Questionnaire Respondent's Age

Respondent's Age	Number of Respondents	Percentage	
18-24	**163**	14.4%	14.4%
25-34	**151**	13.3%	13.4%
35-44	**115**	10.1%	10.2%
45-54	**168**	14.8%	14.9%
55-64	**230**	20.3%	20.4%
65+	**302**	26.6%	26.8%
Refused	**5**	0.4%	
Total	**1,134**	**100.0%**	

Note: All Percentages might not add up to 100 per cent due to rounding errors

Source: Author

As demonstrated within Table 4.8, the proportion of the young people completing the second questionnaire is much greater compared to the first. One possible explanation is that due to it been a much shorter questionnaire, young people will have more available time to complete the survey.

Table 4.8 – The Second Questionnaire Respondent's Age

Response	**Frequency**	**Percentage**	**Valid Percentage**
18-24	**398**	23.4%	23.5%
25-34	**291**	17.1%	17.2%
35-44	**260**	15.3%	15.4%
45-54	**301**	17.7%	17.8%
55-64	**274**	16.1%	16.2%
65+	**170**	10.0%	10.0%
Refused	**6**	0.4%	
Total	**1,700**	**100.0%**	

Note: All Percentages might not add up to 100 per cent due to rounding errors

Source: Author

It should be noted that the sample was considered suitable for this study as numbers or respondents are sufficiently high in each group and the research makes no claim to present a representative sample of the UK population structure as a whole.

4.2.7.3. Political Identification

As highlighted in the previous chapters, political identification has been demonstrated to have an impact on an individual's perception of and therefore engagement with climate change.

Within this survey, the respondents were asked which political party they identify with, and then a generalised political portioning of the sample was applied. For example, individuals indicating the Labour and the Green Party are in this survey grouped as being of a generally more left-wing political position. This was undertaken, as some members of the public might not know the difference between left- and right-wing politics as interpreted in early 21st century context. It can also be noted that for the second questionnaire, a fourth category was identified to accommodate the Brexit Party for which some of the membership had come from the Labour Party in the context of Brexit, despite the party been right-wing. It is also recognised that the identification of left or right around the central margins can be blurred such that, for example, in some interpretations both centre and right-wing respondents might be viewed as right wing from some positions within the left-wing.

Table 4.9 Demonstrates the responses based upon the first questionnaire, whilst Table 4.10 the responses for the second questionnaire.

Table 4.9 – The Political Leaning of the Respondents in the First Questionnaire

Respondent's Political Position	**Number of Responses**	**Percentage**	
Left-Wing	**517**	45.6%	53.8%
Centre	**148**	13.1%	15.4%
Right-Wing	**296**	26.1%	30.8%
Unknown	**173**	15.3%	
Total	**1,134**	**100.0%**	

Note: All Percentages might not add up to 100 per cent due to rounding errors

Source: Author

Within both Table 4.9 and Table 4.10, it was found there is a higher percentage respondents identifying with more left-wing parties, and for Table 4.9 when taking out those of unknown political positions, 53.8 per cent of the respondents had a left-wing political position compared to 30.8 per cent who have a right-wing political position, albeit the care that is needed is in how to consider those indicating ‘centre’ politics. However, a likely reason for the higher numbers on the left is that these political parties have a stronger environmental ideology (Neumayer, 2004; Mooney, 2006)[39], which means that this questionnaire is likely to interest them more. As highlighted within Table 4.10, this divide became larger in the second questionnaire, which would be in part due to a higher proportion of voters between 18 and 24, which are known through recent election results to be more likely to vote for left-wing parties.

Table 4.10 – The Political Leaning of the Respondents in the Second Questionnaire

Respondent’s Political Position	Number of Responses	Percentage	
Left-Wing	**881**	51.8%	63.20%
Centre	**274**	16.1%	19.7%
Right-Wing	**198**	11.7%	14.2%
Brexit Party	**41**	2.4%	2.9%
Unknown	**306**	18.0%	
Total	**1,700**	**100.0%**	

Note: All Percentages might not add up to 100 per cent due to rounding errors

Source: Author

4.3. Interviews

Within qualitative research, interviews are the most widely used technique (Cassell, 2005). As individuals, we actively engage with interviews each day during general conversation with friends and family, with each of us as the ‘interviewer’ and ‘interviewee’ (Edwards and Holland, 2013; Alsaawi, 2014). Patton (1980) describes the purpose of interviewing as being to find out what is in someone else’s mind and those things that cannot be observed directly. It is also described by Fontana and Frey (1994), as a popular and useful way to understand human beliefs. An interview can be conducted in three different ways: structured, semi-structured, and unstructured (Bryman, 2001). For the interviews conducted for this thesis, a semi-structured format was used. This gave the interviewer and interviewee a knowledge of what themes were going to come up, as the interviewees were given a list of themes beforehand, but also the freedom to further discuss points that the interviewee raises that the interviewer feels are important (Oppenheim, 1992).

Each interview was recorded with the permission of the interviewee as recording allows for a great accuracy and speed of transcribing the interviews. Before each interview, the interviewees were asked

[39] - See section 3.2.1.1 for further details about political position and climate change

to complete a permissions form, as demonstrated in Appendix U. This form explains to the interviewee the purpose of the interview, the protection of the data and themselves, such as anonymity. Lastly, it gives them contact details, so they can find out more information about the research and/or if they wish to withdraw certain sections or the entire interview, which is in line with academic best practice.

Within this thesis, five interviews were conducted. A larger number was not considered necessary as the questionnaires, which are extensive, had already proved significant amounts of qualitative information due to the high levels of response. The purpose of the interviews were nonetheless conducted to ask for clarity in areas related to some of the responses from the questionnaire, or in one case, an insight into the education of climate change within schools from a current teacher. Some of the broad themes that were discussed within the interviews included:

- Education on Climate Change
- Engagement of Climate Change
- Thoughts about Climate Change (including the Causation, and Impacts)

After these interviews were conducted, the author transcribed recordings. When these were completed the author coded the interviews; a full break down of how this was undertaken is provided in Section 4.6.

The use of the data from the interviews was predominantly used to shape ideas and theories. However, in one case, a respondent retold an important story in the case of how they personally experienced a teacher being selective and dismissive in relation to the belief of natural climate change. The use of this quote was important in debating the ethical and moral issues surrounding teaching climate change within the education sector.

4.4. Secondary Data Analysis

Secondary data analysis is a method of using existing data from previous studies and using it for a different purpose to the original source (Johnson, 2014). Szabo and Strang (1997) stated that this can be done by either having a new resource question or looking at an alternative perspective. Quantitative data is commonly used for secondary data analysis (Hinds, Vogel and Clarke-Steffan, 1997; Long-Sutehall, Sque and Addington-Hall, 2010). Secondary data analysis has become increasingly popular within academic research, not least due to its increased abundance (Goodwin, 2012; Cheng and Phillips, 2014; Johnson, 2014). Secondary data analysis used in this thesis related to the public's perception of climate change in collected previous works, such as for example in Poortinga *et al.* (2013) and as outlined in the next section.

4.4.1. Secondary Data Analysis within this Thesis

Secondary data analysis has been used within this study in the context of data that has been collected within the questionnaires for which comparative previous studies are used to observe trends over time. See Appendix V for a list of sources that have been used.

In addition, this thesis has used questionnaire data that have been collected by the Department of Energy and Climate Change [DECC] until 2016 and then by the Department of Business, Energy & Industrial Strategy [BEIS]. These questionnaires about the British public energy and climate change perceptions are collected roughly every three months; a timeline of data collection is available in Appendix W of this thesis. As demonstrated there have been 34 sets of questionnaires since 2012 and this allows an analysis of perception over a timescale of eight years; a breakdown of the respondents of these questionnaires is available in Appendix W. An example of the questionnaire is available in Appendix X of this thesis and full overview results from these are available in Appendix Y. These datasets have previously been subject to overall cross-sectional analyses but have not analysis of change over time or between different socio-economic groups.

Also, this thesis has used the questionnaire data that has been collected by the European Commission within its Eurobarometer series. The EC usually runs a focused Eurobarometer questionnaire every two years that collects the thoughts of the civil society within all European Union countries, including the United Kingdom. There are eight sets of data that have been collected, and will be analysed for overall trends, but also between different socio-economic groups over time. However, unlike the secondary data collected from DECC and BEIS, it allows the research to be based upon the differences in overall United Kingdom perception and engagement in comparison with other EU countries. It also allows this comparison to be undertaken between young people from different countries. An example of the questionnaire is available in Appendix Z, with full results in Appendix D.

Lastly, Google Trends has also been used within Chapter Five. This was to observe the influence of major media events on how the public seek information. This has not been limited to just climate change, but other perceived threats that the British public have rated highly previously.

4.5. Statistical Analysis

As demonstrated within Figure 4.4, there are two different types of statistics, Enumerative and Inferential.

Enumerative Statistics, also known as Descriptive Statistics, is the practice of describing the main features from a collection of data (Mann, 1995), whereas, Inferential Statistics is where there is generalisation, predication, estimations and conclusions from data which has been collected from a survey (Upton and Cook, 2008).

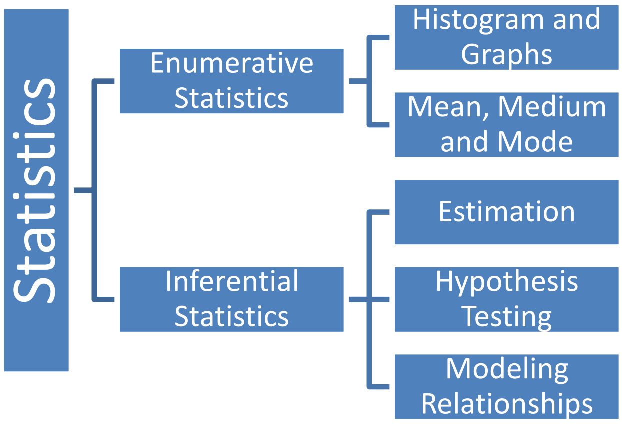


Figure 4.4 – Different types of statistics (Source: Adapted from Trochim and Donnelly, 2006)

The following sections demonstrate all types of statistics that have been used within this thesis. Microsoft Excel and SPSS programmes were used to compute the statistics that are demonstrated in the following sections.

4.5.1. Enumerative Statistics

Enumerative statistics are defined as “quantitative measures derived from a set of data that describe how values are distributed within that data series” (Castree, Kitchin and Rogers, 2013, p.100). Within this thesis, the main enumerative statistical measure that has been used is the mean of the values. This was chosen over mode or the medium. As most of the questions are Likert Scale, it means that all of the responses can be included, but also means that potential polarisation in responses is shown. The other enumerative statistical measure used is the standard deviation. This is used to inform the reader about the spread of the data being presented from the mean value, whereby the larger the value the less homogenous the data.

4.5.2. Inferential Statistics

Within this thesis, two main inferential statistics have been used to analyse the quantitative data, these being the Pearson's chi-squared test and a Fisher's Exact Test. The following two sub-sections detail why these have been chosen and how they have been used.

4.5.2.1. Significance Testing – Pearson's chi-squared test

A Pearson's chi-squared test is an inferential statistical test which tells the probability of independence between two groups of data. It does not inform any additional details about the relationship. A chi-squared test has been used throughout this thesis to compare differences in responses between different socio-economic groups.

Usually, 90, 95 and 99 per cent significance levels are used to describe the data, with most research using the 95 per cent level (Craparo, 2007). Within this thesis, a significance level of 95 per cent has been the level required to consider there to be a statistically different value, but if data has a p-value between 0.06 and 0.10, then a significance level of 90 per cent has also been acknowledged. In similar fashion, if a p-value of either 0.00 or 0.01 was revealed, then a significance level of 99 per cent has been acknowledged. Any other value indicates a non-significant relationship is being reported. Table 4.11 summarises the meaning of the 90, 95 and 99 per cent significance within this thesis.

Table 4.11 - Levels of Significance Difference

Per cent Significance	p-value	Meaning
99%	0.000-0.015	Large Significance
95%	0.016-0.055	Significance
90%	0.056-0.105	Small Significance
>90%	0.106-1.000	No Significance

Source: Author

4.5.2.2. Fisher's Exact Test

Fisher's Exact Test is also a statistical significance test (Fisher, 1922; Agresti, 1992). It is an alternative method to calculate whether the p-value works from a 2x2 contingency tables, in a similar way to which the chi-squared test does, though is commonly used for a small sample size. For example, this is the case for when the observed number is under five, which means that the chi-squared test cannot acutely calculate the p-value (Yates, Moore and McCabe, 1999). As it works similar to a Person's chi-squared test, the levels of significance of the p-values are the same as listed in Table 4.11.

4.6. Content Analysis

Content Analysis is defined as a flexible research method to analyse text data (Cavanagh, 1997), that draws conclusions from observations of content (Stempel, 1981). Content analysis was first used in the 19th Century in Scandinavia (Rosengren, 1981). Originally, content analysis was used in both qualitative and quantitative research (Hsieh and Shannon, 2005). However, in recent years, it has predominantly been used with qualitative data, thus gaining its other name of qualitative content analysis (Morgan, 1993).

There are three main contrasting types of content analyses; these are conventional, directed and summative. Table 4.12 highlights the differences between the three versions providing the rationale of its application in this research.

Table 4.12 - Coding Differences between the Three Approaches to Content Analysis

Type of Content Analysis	***Study Starts With***	***Timing of Defining Codes or Keywords***	***Source of Codes or Keywords***
Conventional content analysis	Observation	Codes are defined during data analysis	Codes are derived from data
Directed content analysis	Theory	Codes are defined before and during data analysis	Codes are derived from theory or relevant research findings
Summative content analysis	Keywords	Codes are defined before and during data analysis	Keywords are derived from interest of researchers or review of literature

Source: Hsieh and Shannon, 2005 (p. 1286)

Within this thesis, conventional content analysis has been used for both the interviews and documents that focus on the educational syllabus within the United Kingdom; which aimed to answer the research question, “In what way, and how important is education in engaging the youth in climate change?”. This thesis has followed the eight steps to coding qualitative data as highlighted by Zhang and Wildemouth (2009); which are:

1. Prepare the Data
2. Defining Units of Analysis
3. Develop Different Categories and Codes
4. Test the Codes
5. Code the Text
6. Check Codes for Consistency
7. Make Theories/Conclusions from the Coded Data
8. Report the Findings

4.7. Yonmenkaigi System Method for Observation of Engagement

Yonmenkaigi System Method is a participatory method which was originally developed in the mid-1980s in Chozi, Tottri Prefecture, Japan (Okada *et al*., 2013). The Yonmenkaigi System Method has typically been used post-disasters within Japan and was especially useful in the aftermath of the 1995 Great Hansin Earthquake Disaster, in Kobe, Hyōgo Prefecture (Na, Okada and Fang, 2009).

The relevance of this approach to this research was that the Yonmenkaigi System Method had developed as an action with local communities through interactive workshops (Na, Okada and Fang, 2009) and offered particular consideration of engagement processes. It is recognised that there are a variety of participatory methods available that claim engagement, though this one has been used particularly in disaster risk settings. An opportunity for the author to engage in it through his association with work by Japanese scholars was also a factor in its selection. Samaddar *et al.* (2015) describes how the Yonmenkaigi System Method framework allows stakeholders to debate an issue through face-to-face communications during which they learn about other people's points of view on such issue. The main purpose of using this method was to test whether using participatory approach in the education of climate change can yield a higher degree of concern about climate change to potentially get young people to engage with the issue further, either in the short or medium term. The usage of this method was further determined after research in Section 6.2 demonstrated that education of climate change within the United Kingdom is still being taught using a film or being told by the teachers as facts before moving onto the next topic. Research presented in Section 3.4.2 demonstrated that attention rates in classes fluctuates, especially when being talked to. It was considered in the context of the research for this thesis that if the students have the ability to talk about the issue with their fellow classmates, that they will stay alert for much longer and it might make them more willing to openly talk about such issues as engaging their practices around the issue in the future, without feeling uncomfortable.

For this research, the Yonmenkaigi System Method study was conducted on the 11th October 2018 at Northumbria University within Newcastle-upon-Tyne in the North East of England. The students who participated in this study were sixteen first year undergraduate students on the environmental management course, as demonstrated in Figure 4.5. The exercise was conducted on the first week of study and therefore students were limited to very little to no information about climate change. As a result, the students would only have the knowledge that they were either self-taught via their own interactions or were taught within formal education.

Figure 4.5 – The students debating during the Yonmenkaigi System Method exercise (Source: Author)

4.7.1. Yonmenkaigi System Method Process

Firstly, it is important to determine how many participants were allowed in the workshop. A typical Yonmenkaigi System Method Workshop has between eight and sixteen participants and a facilitator (Okada *et al*., 2013). Within this case, it was felt that it would be better to use the maximum recommended amount of sixteen participants, as it would be more representative of usual class sizes within schools and/or colleges.

After this, the method itself is engaged. As demonstrated in Figure 4.6., the Yonmenkaigi System has four different components: undertaking a SWOT Analysis, completing a Yonmenkaigi Chart, debating, and preparing and presenting action plans.

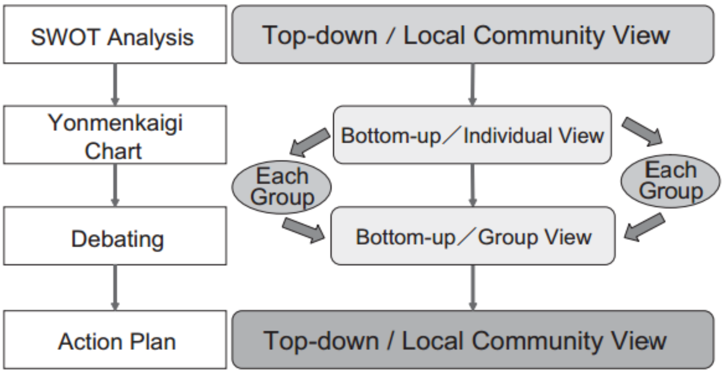


Figure 4.6 – The Yonmenkaigi System Method Framework (Na, Okada and Fang, 2009 p.60)

However, within this thesis, another two steps were added to test the change in perception of climate change before and after the application of the Yonmenkaigi System Method; this change is illustrated in Figure 4.7. Note, that the identification stage, within Figure 4.7, is often included within the SWOT Analysis.

Figure 4.7 – Yonmenkaigi System Method's seven steps (Source: Author)

When undertaking the Yonmenkaigi System Methods, there are basic characteristics that need to be considered, such as the objective, the theme and scenarios that are being tested. A full overview of the basic characteristics is demonstrated within Table 4.13. Overall, this was an important supplement to the work of this thesis as it also enabled and assessment of likely processes of perception, engagement and response of the young people through direct observation.

Table 4.13 – Basic characteristics of the Yonmenkaigi System Method

Application	Disaster mitigation and prevention
Objective	Collecting visions and hopes of residents for proactive disaster reduction planning
Who Decides the Theme and Scenario	The facilitator suggests guidelines and participants determine the theme and scenarios
Participants	Self-governed community association for disaster reduction (as representatives of residents)
Facilitators	Specialists
Typical Size	One team (8 to 16 people), four groups (2 to 4 people each)
Outcomes	Development of an action plan for disaster reduction for the local community

Source: Na, Okada and Fang (2009, p.63)

Before undertaking the method, a theme and scenario needed to be determined. Within this thesis, the theme used for the Yonmenkaigi System Method was "climate change within Newcastle-upon-Tyne". The scenario/brief that was given to the students was; "You are being asked by Newcastle City Council to discuss and give ideas to what can Newcastle do to reduce the effects of climate change through mitigating and adaption". A full brief that was given to the students can be found in Appendix AA. This scenario was left quite open, as it would give the students room to express their feelings about climate change, as well as what can be undertaken.

The first step within this method was a questionnaire. This questionnaire uses ten questions that explores the students' perception of climate change, including personal responsibility about climate change, mitigation policies, and the impacts of climate change. See Appendix AB for a full version of this questionnaire.

The next step was to undertake a SWOT (Strength, Weakness, Opportunities and Weakness) Analysis within the exercise. A SWOT Analysis allows the participant to share their ideas and views about the positives and negatives of their local community. As highlighted in Figure 4.8, for a SWOT Analysis, there are four different components: Strengths, Weakness, Opportunities and Threats. These four components are broken down into two categories, known as internal and external factors. Using a SWOT analysis within the Yonmenkaigi exercise was important, as it helped participants to see the present and future risks to their community and therefore helped them recognise that action is needed to reduce these risks (Na, Okada and Fang, 2009). This is especially important in relation to climate change, as it is in the context of this research considered good for students to understand that there are some opportunities associated with climate change within the United Kingdom. This is important, as by teaching only the 'doom and gloom' of climate change, could lead to 'eco-anxiety'[40] (Harrington, 2020); which in turn can lead to disengagement due to the feeling of fear (Georgiou *et al.*, 2005) and/or hopelessness on trying to either mitigate and/or adapt to climate change.

Internal Factors	
Strengths	**W**eaknesses
External Factors	
Opportunities	**T**hreats

Figure 4.8 – SWOT analysis (Source: Author)

Following the SWOT Analysis, the participants were then split into four groups. The students were then asked, based upon the results of the SWOT analysis, to identify stakeholder roles that were required to fulfil the brief. Four of the most important roles were chosen, and each group of students were assigned a role. The four chosen were 'Communication and Engagement', 'Mitigation', 'Resources and Logistics', and 'Research and Data'.

Once all stakeholders have been assigned a role, then each respondent was asked to convey their action components and views in accordance with their role. This was done by using a colour card placed in the Yonmenkaigi Chart (Na, Okada and Fang, 2009), which is demonstrated within Figure 4.9. Within the Yonmenkaigi exercises undertaken within this thesis, each role is assigned the following colours:

1. Communication and Engagement [Green]
2. Mitigation [Blue]
3. Resources and Logistics [Yellow]

[40] - sometime researchers refered to it as 'eco-fear' (Buzzell and Chalquist, 2019).

4. Research and Data [Red]

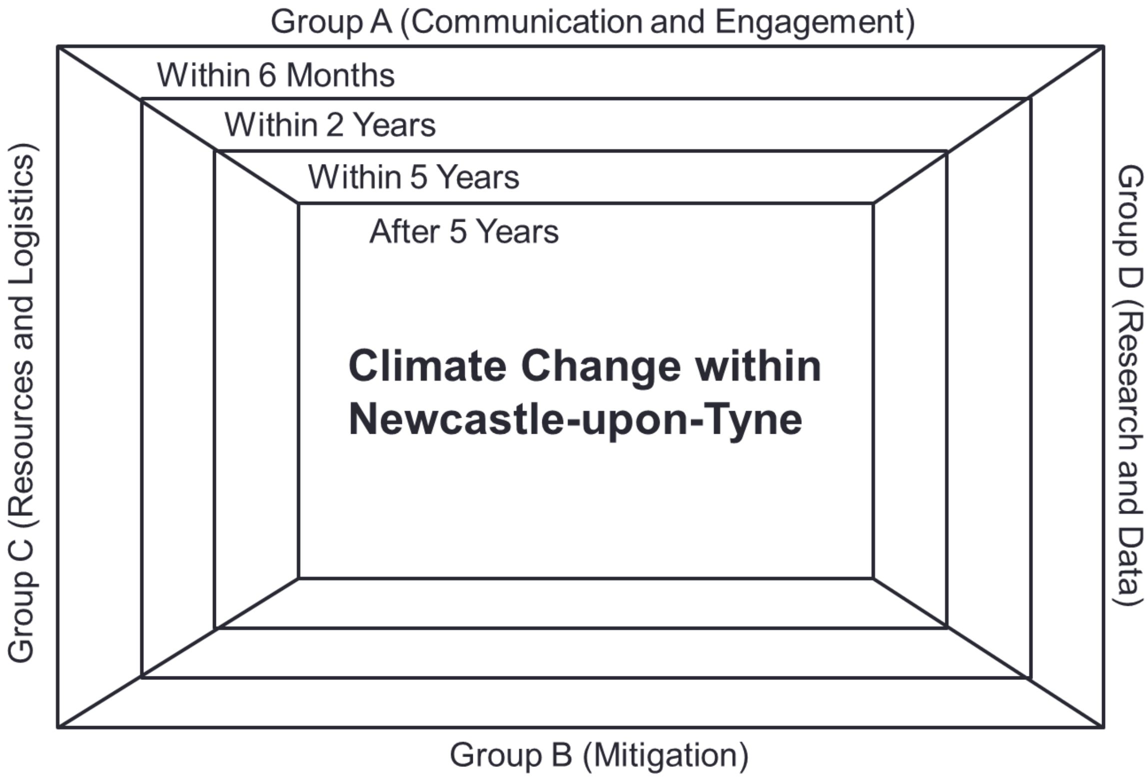


Figure 4.9 – Application of Yonmenkaigi Chart (Source: Author)

Within the Yonmenkaigi Chart, each group is split into a further four sections, each represents a different time. It should be noted that these time scales are not fixed, and different time scales have been used previously. This was demonstrated by Samaddar *et al.* (2015) who allocated timescales of within 3 months, 6 months, 1 year and after 1 year; whereas, Na and Okada (2011) allocated a timescales of within 3 months, 6 months, 1 year and 2 years. Within this Yonmenkaigi, the students choose timescales of within 6 months, 2 years, 5 years and after 5 years. The reason given by the students for the longer timescale compared to the previous examples was due to climate change not being a quick fix and as an issue that impacts on Newcastle for the short, medium and long term.

The next stage of the YSM process, as demonstrated in Figure 4.7 is debating. The purpose of the debating is to provide a platform to process all the ideas by each group, which allows the ability of the students to further develop a potential combining of ideas together (Samaddar et al., 2015). Within the YSM process, two types of debating are available to the group; these are general debating and inverse debating (Na *et al.*, 2009). For general debating, two groups debate with each other to defend their own ideas (Samaddar *et al.*, 2015). By way of contrast, inverse debating is when two groups swap position, and start debating in relation to their new group (Na, 2016). For example, if group A and B are debating; when inverse debating occurs, Group A must defend the ideas of B. The purpose of the inverse debating is that it challenges their thinking about the idea, especially when it is not their own. As the students have written their ideas on card, when debating, the students can move the cards around, including adding and removing cards when appropriate.

After the debating is completed, an Action Plan Chart was created; an example of one of these is demonstrated in Figure 4.10. The action plan chart is classified in accordance with the time frame and each of the four roles (Samaddar *et al.*, 2015).

Time ---→

	6 Months	2 Years	5 Years	Beyond 5 Years
M				
I				
S				
H				

Figure 4.10 – Action plan chart in the Yonmenkaigi System (Adapted from Na, Okada and Fang, 2009)

Lastly, the final step of the Yonmenkaigi used within this thesis was a second questionnaire. This was used to compare the results to the first set of results, to determine whether any changes in the perception could be detected amongst the sixteen students.

It is important to note, that both the change in perception and also the changes which occurred as they discussed and engaged with the topic that are important to this exercise. This type of change is not easily judged with questionnaires, therefore observational analysis was undertaken for this sample by the researcher.

4.7.2. Reflection on Participatory Action Research

Participatory action research [PAR] is a research approach within a community which emphasises participation and action, as demonstrated within Figure 4.11. The main objective of PAR is to understand and improve the environment by changing it (Baum, MacDougall and Smith, 2006). As highlighted by Tandom (1988, p.7) “participatory research attempts to present people as researchers themselves in pursuit of answers to the questions of their daily struggle and survival”.

McIntyre (2008) highlights that whilst undertaking PAR research, there should be four steps undertaken, which are the following and are demonstrated within the spiral within Figure 4.11:

- Questioning of the issue

- Investigate the issue and reflect from a personal standpoint
- Develop an action plan
- Implement the action plan and refine when necessary

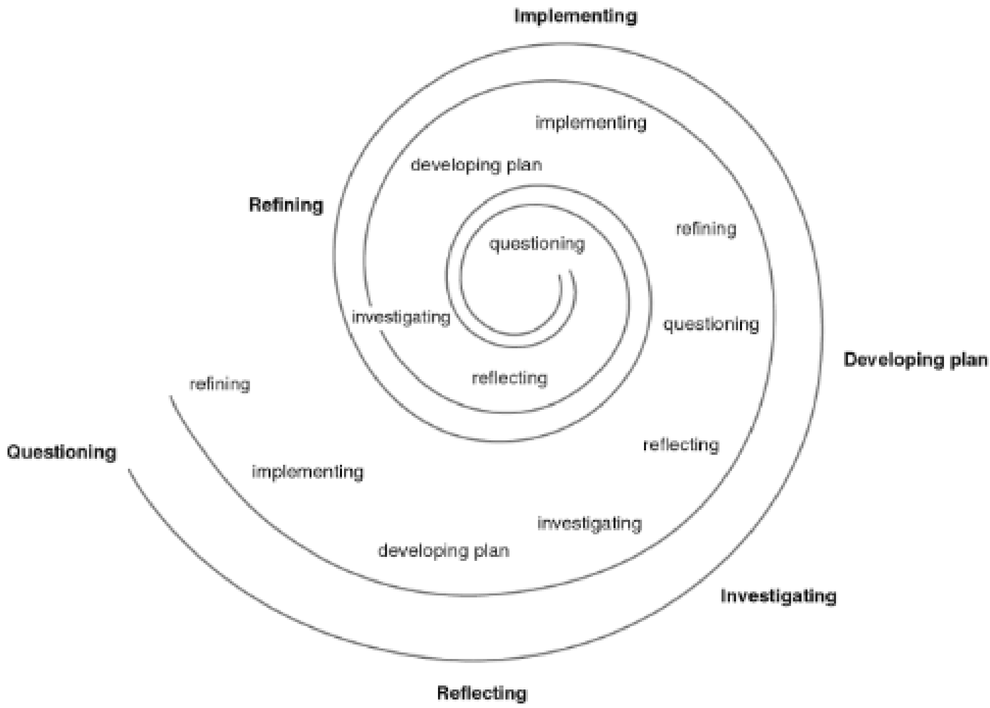


Figure 4.11 – The recursive process of participatory action research (Source: McIntyre, 2008, p.7)

As a consequence, the participatory action research concept and application has applied in this research for this thesis, in both that the potential for students to be stimulated when exploring the issue of climate change and in the overall protracted engagement of the author in the topic over the years of the research. In addition, it goes further, such as where students and all participants in the research process could start to question and reflect on how their perception, engagement and ultimate responses to the topic impacts on their lives, both now and in the future. At minimum the methodology and technique applied for this thesis intended to lead to participants gaining a reflective and increased understanding of the importance of such an issue. Lastly, it would be hoped that through these processes the younger people in society will be more comfortable to speak about such matters, which due to future demographics will impact on their lives more than any other generation to date.

4.8. Ethics

Ethics are defined as “a set of concepts and principles that guide us in determining what behaviour helps or harms sentient creatures” (Paul and Elder, 2006, p.2). In addition, Kidder (2003, p.63) stated that ethics is “the science of moral duty”. The definitions are similar, they highlight that ethics are a set of rules that should present research and its findings causing undue anxiety or harm towards its participants.

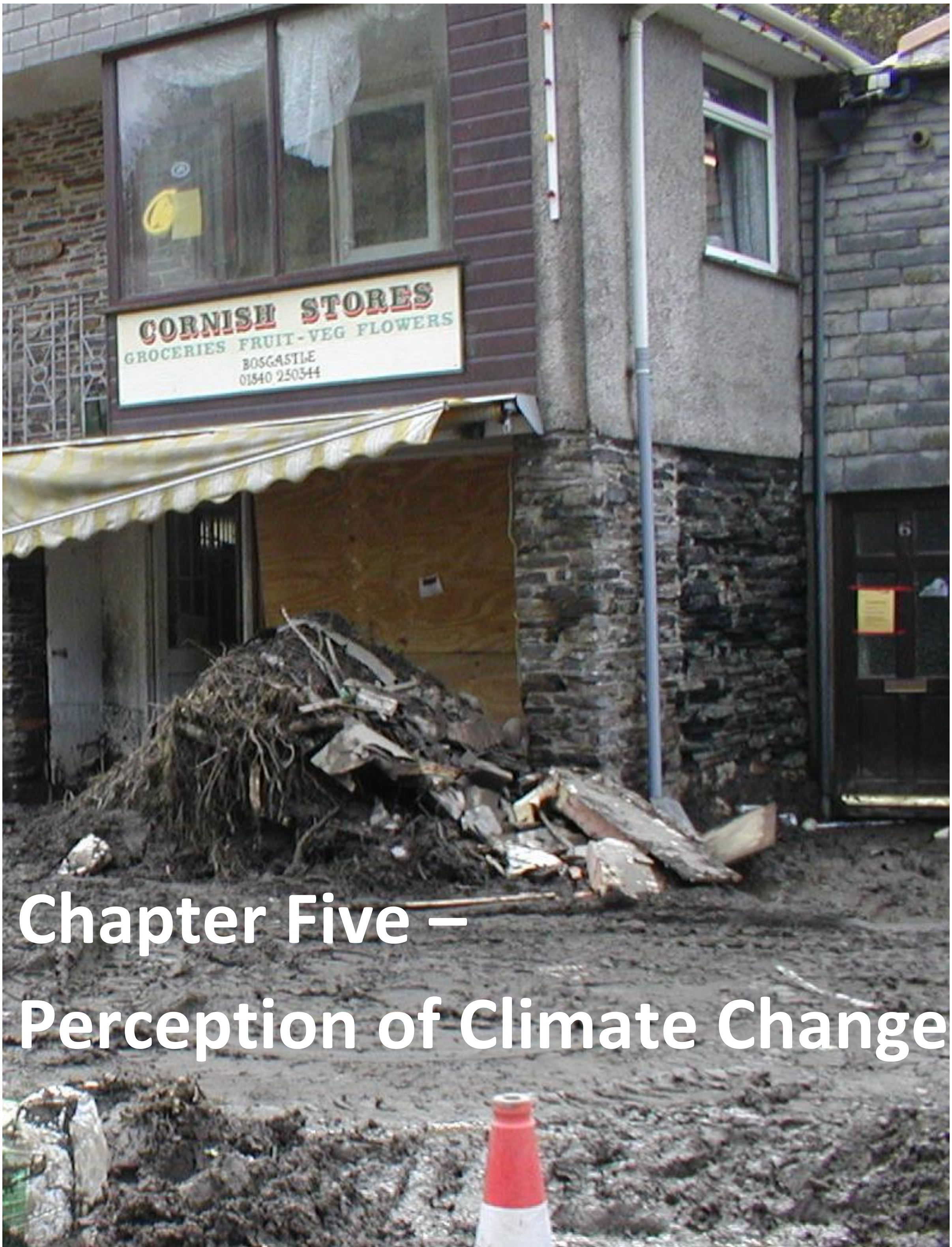
Underlying this research was an understanding that ’modern ethics’ guidance has its origins in post-World War II at the Nuremberg Trials. This was due to the forced human experiments which were carried out by Nazi Germany during World War II within the concentration camps (Roelcke and Maio, 2004). Declaration of Helsinki [DoH] is a set of ethical practices regarding human activity in research, which was developed by the World Medical Association [WMA] (WMA, 2013). However, the Declaration of Helsinki is widely regarded as the essential document for research involving humans in all fields (Burgess, 1989; Babbie, 1998; Ezzy, 2002; WMA, 2013).

Beyond this grand narrative, which is upheld by this thesis, the research complied in detail with the guidelines outlined by Northumbria University, Research Ethics and Governance Handbook (Northumbria University, 2015). Northumbria University has a policy that requires an application and approval of research before any research is undertaken and this was fully granted following due process.

Before the collection of data from human participants, either via the form of questionnaires or interviews, either online or in person, a consent form was filled in. The consent form explained the project and participant individual rights, including issues about anonymity, confidentiality and withdrawal rights; this complies with both the outgoing Data Protection Act 1998 and the incoming EU General Data Protection Regulation of 2018.

All data that has been collected at all times has been stored in a secure location in accordance with the Data Protection Act 1998. Therefore, all coded data has been stored on a computer, with each file having password protection to stop unauthorised access. In addition, all paper-based copies of questionnaires were stored within a filling cabinet, which was lockable with a key and stored a room that is locked with a key.

Within all aspects of the research and the writing up process of this thesis non-gender related language has been used. This is because language like “manmade” and “mankind” can be viewed as sexist language (Douglas and Sutton, 2014); therefore, words like “human made” have been used instead. It is recognised that sexist languages can lead to potential exclusion and trivialisation of either gender, in particular for women and girls (Doyle, 1998; Parks and Robinson, 2004; Croswell, 2009).



Chapter Five – Perception of Climate Change

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"If the planet were a patient, we would have treated her long ago. You, ladies and gentlemen, have the power to put her on life support, and you must surely start the emergency procedures without further procrastination"

Charles, Prince of Wales (2015) at the World Economic Forum

This chapter addresses the first overarching research question (Section 3.9) and climate change perception in terms of socio-demographic groups, including age, gender, location and political affiliation. This includes perception of climate change impacts, differing terminology, scientific consensus, trust, climate policies, energy, transportation and media reporting. Overall, it is argued that complex perception of climate change underlies the way different groups engage with climate change.

The findings are supported by analysis of respondents from different socio-demographic groups participating in the two surveys and secondary data compared for significant differences using a routine of chi-square testing. Abbreviations *, **, and *** are used to indicate 0.10, 0.05 and 0.01 significance levels, respectively. The chapter comprises 11 sub-sections that examine different elements of climate change perception. Figure 5.1 demonstrates how each of the sub-sections interlinks, with the arrows on the right side indicating particularly strong relationships between the subsection themes. This structure is determined from the themes that emerged from the questionnaires.

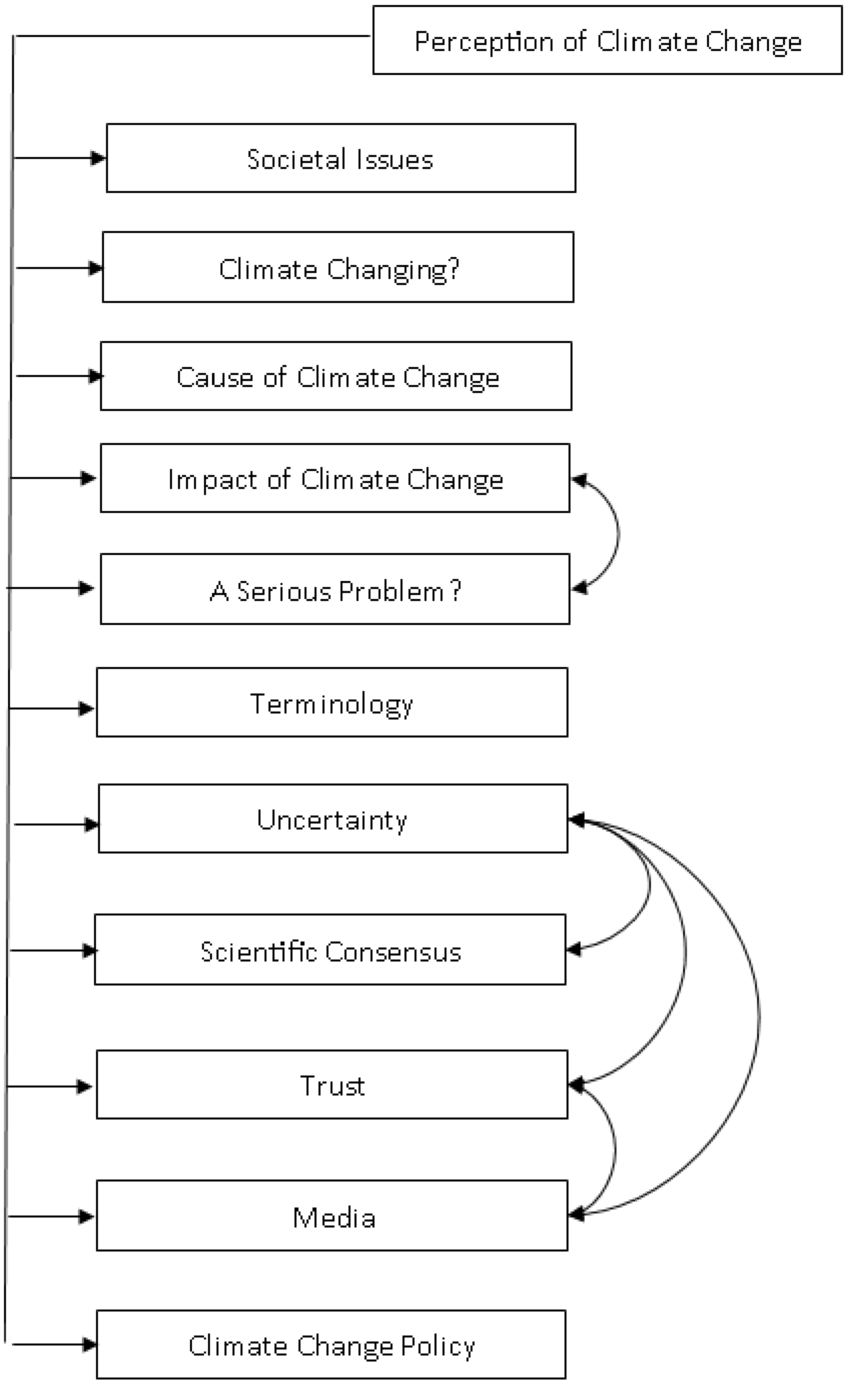


Figure 5.1 – The overall structure of chapter 5 as representing interlinked influences on Climate Change perception within the United Kingdom

Source: Author

5.1. Greatest Societal Issues?

In recent years, British and global societies have faced a myriad of threats. These range from infectious diseases, such as Ebola (Cooper, 2014; BBC, 2015), measles (New Scientist and PA, 2019; WHO, 2019) and the COVID-19 pandemic (Ferguson *et al.*, 2020), to terrorist attacks in London (Dearden and Bulman, 2017), Manchester (BBC, 2018) and Paris (Chow and Kostov, 2015) to threats of the use of nuclear weapons in 2017 between North Korea and the United States (Johnson and Yoshida, 2017; Shugerman, 2017). Consequently, for some members of the public it can often feel that there is so much to be worried about in the short-term, that long-term issues can wait. This is known as a 'finite pool of worry', being when an individual only has a rudimentary capacity for worry about issues that will affect themselves (Linville and Fischer, 1991). This means that individuals are limited to how many issues they can focus on at any one time. They tend to pick on issues that require more attention in the short-term, leading to other medium to long term issues being left to one side (Weber, 2006). This results in a cunctation of meaningful action in either mitigating or adapting to climate change and a consequent low cognitive engagement with climate change. An example of this is the 2008-09 Great Recession. At the time, public concern about climate change declined about 14 per cent, which in part was due to the increased worry about economic instability and job security (Weber, 2010; Leiserowitz *et al.*, 2013).

Short-term societal issues that civil society faces, can lead to reduced levels of worry about, and engagement with, climate change mitigation and adaptation. However, this raises questions as to how the public view these societal issues compared to climate change. Accordingly, the respondents within the first questionnaire were asked "Which of the following do you think is the greatest threat that we currently face?" and were given a list of eight to choose from, including, but not limited to, climate change, diseases, and terrorism[41].

It was found that a preponderance of the respondents of the survey (36.76 per cent) thought that climate change is the greatest threat that society faces currently; but, it should be noted that there may be bias, as the respondents knew about the theme of the research project before completing the questionnaires. This was followed by terrorism and economic instability, with 19.93 and 12.75 per cent respectively. Espionage had the least responses (0.26 per cent). In addition, climate change was the most selected response of all age groups. However, the proportion of concern is not equally spread amongst the age groups, with the 18-24 group being the most concerned at 42.33 per cent; Whilst the 35-44 age group [least concerned] response rate for climate change was 32.17 per cent there is not a significant difference between these two age groups at the 5 per cent level of significance, just at the 10 per cent level ($\chi 2=2.949$, $p=0.086$*).

[41] - Each of the eight terms are defined in Appendix AE.

These results suggest that across the age spectrum, there is an overarching concern about climate change, compared to other social issues. However, the results could be interpreted in varying ways.

These results suggest that across the age spectrum, there is an overarching concern about climate change, compared to other social issues. However, the results could be interpreted in varying ways.

Table 5.1 – Respondents perception of the largest societal issue in 2017 overall and by age groups

	18-24	25-34	35-44	45-54	55-64	65+	Overall
Climate Change	**69** (42.33%)	**62** (41.06%)	**37** (32.17%)	**59** (35.12%)	**82** (35.65%)	**106** (35.10%)	**415** (36.76%)
Diseases	**6** (3.68%)	**5** (3.31%)	**6** (5.21%)	**9** (5.36%)	**4** (1.74%)	**13** (4.30%)	**43** (3.81%)
Economic Instability	**12** (7.36%)	**24** (15.89%)	**18** (15.65%)	**24** (14.29%)	**35** (15.22%)	**31** (10.27%)	**144** (12.75%)
Espionage	**1** (0.61%)	**1** (0.66%)	**0** (0.00%)	**0** (0.00%)	**1** (0.43%)	**0** (0.00%)	**3** (0.26%)
Migration	**3** (1.84%)	**5** (3.31%)	**6** (5.22%)	**6** (3.57%)	**8** (3.48%)	**17** (5.63%)	**45** (3.99%)
Nuclear Weapons	**8** (4.91%)	**9** (5.96%)	**13** (11.30%)	**16** (9.52%)	**24** (10.43%)	**46** (15.23%)	**116** (10.27%)
Political Tensions	**23** (14.11%)	**23** (15.23%)	**12** (10.43%)	**23** (13.69%)	**26** (11.30%)	**28** (9.28%)	**135** (11.96%)
Terrorism	**41** (25.15%)	**22** (14.57%)	**22** (19.13%)	**30** (17.86%)	**49** (21.30%)	**61** (20.20%)	**225** (19.93%)
All	**163**	**151**	**115**	**168**	**230**	**302**	**1,129**

Gold = Greatest Societal Issue; Silver = Second Greatest Societal Issue; Bronze = Third Greatest Societal Issue; Red = Least Greatest Societal Issue

Source: Author

It is surprising that the results for climate change were greater than the results from terrorism, as the questionnaires were taken during the time of two major terrorist attacks in both London and Manchester. These findings somewhat go against the hypothesis of Weber (2006) about the 'finite pool of worry' and past research in the aftermath of the Great Recession in 2008. One potential explanation for this could be an increased awareness and observation of severe weather events that could be associated with climate change during this time period, such as the hyperactive Atlantic Hurricane season in 2017 (NOAA, 2017); the heatwave in June that affected South England and Wales (Siddique and Taylor, 2017); and the naming of European winter wind storms by the Met Office and Met Éireann. For example, respondent [OLC199] in the questionnaire survey stated that "flash flooding in summer storms made me realise climate change is real and affecting this country, not just something you see on the news in a faraway land" [55-64, Female, South West England]. This is backed by respondent [OLD109] who stated with a similar remark that "our thunderstorms are getting bigger and more powerful … they are generated by our hotter summers" [55-64, Female, South East England]. These two respondents are highlighting that they have observed significant changes in the British climate in their lifetime. The chapter later explores the awareness of impacts of climate change amongst civil society further.

Another way to test how much climate change is seen as a more important social issue compared to other current events, is to observe whether people think climate change or COVID-19 is the bigger issue. In 2020, humanity experienced its worst pandemic since H1N1 influenza in 1918[42] (Ferguson *et al.*, 2020; Phillips, 2020; Webel and Freeman, 2020); with COVID-19 causing nearly half a million deaths globally [correct as of 24th June 2020]. Due to there being no known vaccine and specific treatment plan, other than symptomatic treatment, it has resulted in most countries, including the United Kingdom (BBC, 2020), introducing strict measures to stop the spread of the virus. The resultant locking down of whole countries and social distancing has led to major social and economic disruption. Consequently, it would have not been surprising, during this period, that most of the concern amongst the public would be about COVID-19/infectious disease over climate change. This is demonstrated in two polls that have been conducted by YouGov during the lockdown within the United Kingdom in April and May 2000. The respondents of both surveys were asked "regarding the overall impact on humanity, are you more concerned about the impact of coronavirus or climate change?". The overall response demonstrates that the public concern about coronavirus increased between April and May from 49 per cent to 52 per cent (YouGov, 2020a; YouGov, 2020b), whereas concern about climate change declined from 32 per cent to 30 per cent. However, the change in perception was not equally spread amongst different age groups. As observed in Table 5.2, the level of concern for Coronavirus has increased amongst every age group, apart from the youngest age group, amongst which there was an increase in concern for climate change. The increase in concern for Coronavirus increases with older age groups. This is not surprising, given that levels of mortality increases for the elderly compared to the young, with more concern about this short-term disaster compared to the long-term disaster that is climate change, which is more likely to impact the younger generations.

[42] - Commonly known as "Spanish Flu"

Table 5.2 – The overall concern amongst respondents about Coronavirus [COVID-19] versus climate change in April and May 2020

	18-24		25-49		50-64		65+	
	22nd April 2020	13th – 14th May 2020	22nd April 2020	13th – 14th May 2020	22nd April 2020	13th – 14th May 2020	22nd April 2020	13th – 14th May 2020
Coronavirus	40%	37%	45%	48%	54%	60%	58%	66%
Climate change	37%	39%	34%	34%	27%	27%	30%	23%
I'm not worried about either	7%	7%	9%	7%	10%	6%	7%	7%
Don't Know	15%	17%	13%	10%	9%	7%	4%	4%

Date Source: Adapted from YouGov 2020a, YouGov 2020b

Now that it has been established that the largest group of respondents in this study believed that climate change is one of the biggest issues facing society within the United Kingdom, it is important to understand this in relation to evidence about comparative climate change denial there may be within British society.

5.2. Do Civil Society Believe that the World's Climate is Changing?

As highlighted extensively throughout section 2.1, the climate is changing. However, numerous past studies have found that there are those who do not believe that the climate is changing (Spence *et al.*, 2010; Poortinga *et al.*, 2011; Shuckburgh, Robison and Pidgeon, 2012; Capstick *et al.*, 2015; Steentjes *et al.*, 2017). It is therefore important to gain an indication of the proportion of the population that are and are not likely to believe that the climate is changing. Survey respondents were asked within both main questionnaires implemented for this research "do you believe that the world's climate is changing?". As highlighted in Table 5.3, this question was framed to be the same as for past research conducted by Poortinga *et al.* (2013).

Table 5.3 – The number of the respondents that believe the climate is changing

Response	February – September 2017		May – July 2019	
Yes	1,077	**94.97%**	1,674	**98.47%**
No	15	**1.32%**	10	**0.59%**
Don't Know + Refused	42	**3.71%**	16	**0.94%**
Total	1,134	**100.00%**	1,700	**100.00%**

Source: Author

As demonstrated in Table 5.3, the clear majority of the respondents believe that the climate is changing, and this rose between 2017 and 2019 by 3.50 per cent from 94.97 to 98.47 per cent. These figures demonstrate that there is increasing certainty amongst the public that the climate is changing. This could be due to the increased frequency and magnitude of extreme weather conditions that have impacted the United Kingdom and around the world during this period. For example, the heatwaves during the summer of 2018 and 2019 provided record temperatures that were recorded in a number of European countries including the United Kingdom. In addition, wildfires, heavy snowfall and numerous flooding events were observed during these two years.

Other studies undertaken during the past fifteen years have also explored this issue. Figure 5.2 compiles data demonstrating the British public's response on whether the climate is currently changing between November 2005 and July 2019. Its shows that it is the most recent results that show the highest proportion of people believing that the climate is changing. In addition, the proportion of respondents who do not believe that the climate is changing reached a record low. It has also been observed that the perceived decline in the number of people who believe that the climate is changing has seemly stopped, and since March 2013 it increased by nearly 25.5 per cent. This trend is observed using a regression analysis, which shows that the regression line through all the "yes" points during the fourteen-year period is:

$$y = 0.0002x^2 - 0.429x + 91.354$$

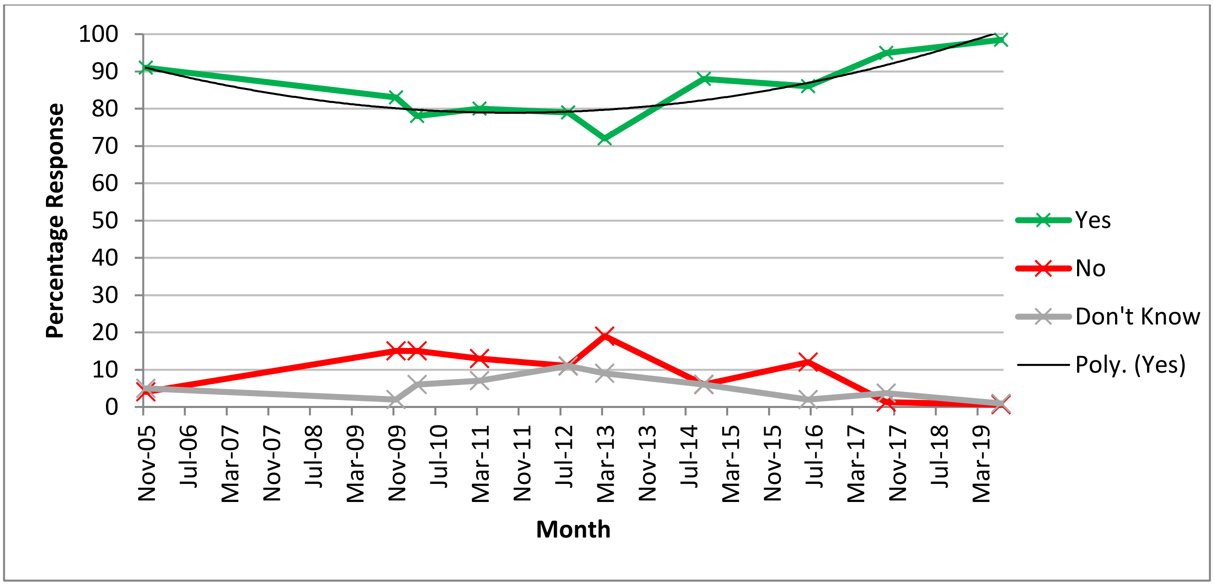


***Figure 5.2 - The change in belief between 2005 and 2019 on whether the climate is changing*.**

(Source: Author). See Appendix C for full figures.

The two surveys from this study are higher than any other observed data points; this could be due to methodological differences between the studies, due to an increased acceptance that the climate is changing or a mixture of both reasons.

5.3. Perception of Change?

As the previous section has demonstrated, the majority of the respondents believe that the climate is currently changing. However, as demonstrated within Section 2.1 and 3.3.2, there are different factors that are influencing this change, both anthropogenic [burning of fossil fuels] and natural [solar activity]. Knowledge of both causes is important, as greater numbers of respondents believing that the main cause of current changes in the climate are natural means these respondents are less likely to believe that individual or societal actions are going to make much difference. In addition, researchers have previously found that some educational institutions have only been teaching about the human processes, so as to avoid confusing their students (Seow and Ho, 2016). This means that there is a possibility that young people might not fully understand and/or appreciate the complexity of the climate system. In addition, when censored information is being challenged, it is likely to lead to more confusion leaving people to believe that there is not a scientific consensus.

Therefore, it is appropriate at this point to determine what the respondents of this study believed is the actual cause of the current change in the climate. Therefore, in both questionnaire 1 and 2, the respondents were asked "what do you believe is the cause of this change [in the climate]?".

Table 5.4 indicates what the respondent believes is the cause for the change in the climate. It demonstrates that there has been a difference in response between the intervening two-year period between the two questionnaires. During the 2017 questionnaire period, a 'combination of human and natural processes' was the most chosen belief (48.15 per cent), whereas in 2019, human processes was selected the most (48.82 per cent). The difference between the two choices has narrowed in the two-year period with no significant difference between the two responses in 2019. This demonstrates that fewer respondents are recognising natural processes only as being involved with climate change and being the cause of the current change in the climate; there are fewer people demonstrating what Mann (2013, p.23) describes as stage three of denial of climate change, which states that "even if there is a warming, it is due to natural causes". This is likely to have ramifications, as, in theory, more people believing that the climate is changing due to human processes should mean that there is a greater proportion also recognising that mitigation is needed to reduce the impacts of climate change.

Table 5.4 – Respondent perception of the causes of climate change

Response	February – September 2017		May – July 2019		Chi-Square
Caused by natural processes, either mainly or entirely	57	**5.03%**	36	**2.12%**	**18.13*** **
Caused by human processes, either mainly or entirely	475	**41.89%**	831	**48.82%**	**13.40*** **
Caused by a combination of human and natural processes	546	**48.15%**	803	**47.24%**	**0.63**
Do Not Believe Climate is Changing	50	**4.41%**	26	**1.53%**	**21.62*** **
Refused / Don't Know	6	**0.53%**	4	**0.24%**	**1.67**
Total	**1,134**		**1,700**		
Chi-Square (H & C)	**22.61*** **		**0.92**		

***** = Significant at the 99 per cent significance; H & C = 'Human Processes' and 'Combination of Human and Natural Processes' respectively**

Source: Author

In addition to the data that has been collected within this survey, this type of question has been asked by researchers for the British Government. This allows the ability to track the response within the United Kingdom for the past eight years. Figure 5.3 presents BEIS survey results alongside this thesis questionnaire response [the data points that have orange diamonds]. It has been noted that the responses from this thesis are slightly lower for the natural and higher for the human processes compared to the BEIS. This is most likely due to differences in surveying techniques. Overall, Figure 5.3 demonstrates that there has been a general decline in those indicating climate changed by natural processes between 2012 and 2019. This reaffirms the thesis results that the British public are increasingly less likely to believe that the current change in climate is due to natural processes; it is then reasonable at this point to postulate that increasingly more believe that climate change is a process in which there is collective responsibility, and that society can limit it.

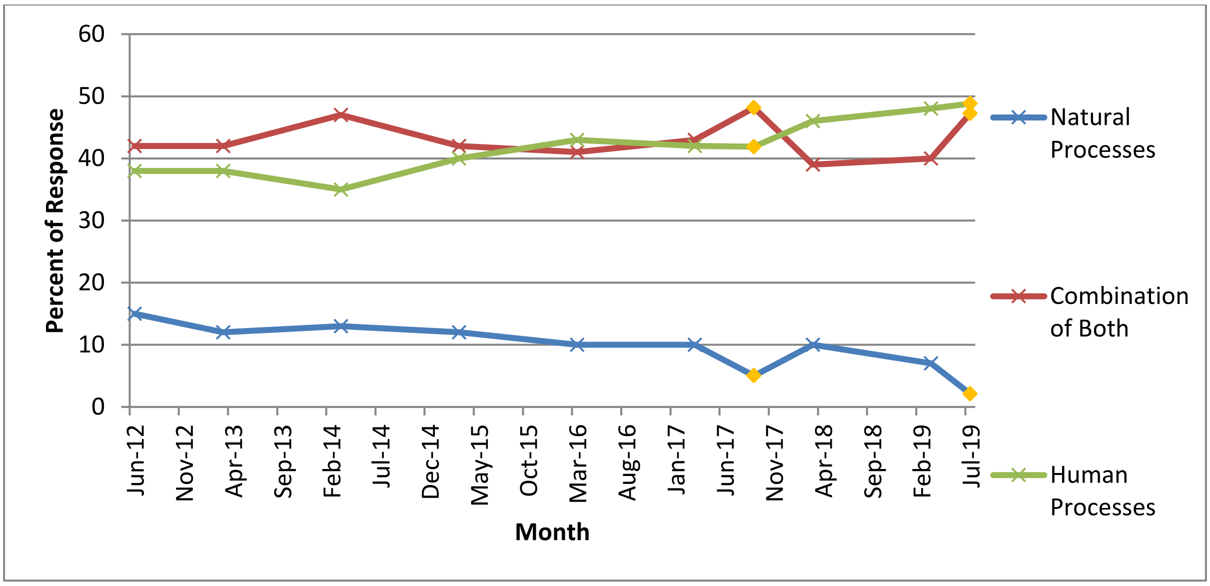


Figure 5.3 – Perception of the Cause of the Current Change in the Climate between June 2012 and July 2019

Gold Diamonds = Survey Data Directly Collected from this Thesis

Source: Full Details of Source Available in Appendix Y

5.3.1. Youth Beliefs

Table 5.5 and 5.6 demonstrates the breakdown in responses to climate change causality by age groups for 2017 and 2019 respectively. It can be observed within Table 5.5 that there is a decline for each age group in those believing the current change in the climate is due to natural processes. There is a significant difference at the 99 per cent level between the proportion of 18-24 and 65+ age groups that believe that the current change in the climate is due to natural processes ($\chi 2=8.494$, $p=0.004$). It can also be observed that only two of the six age group brackets have a higher proportion of the responses for the human processes compared to the combination option.

Table 5.6 demonstrates a distinctive shift towards human processes in all age groups, with only the 65+ group more likely to choose a combination of human and natural processes. However, it should be noted that there is no significant difference for between the human processes and combination option within all age groups.

Table 5.5 – Cause of the current change in the climate depending by age groups in 2017

Response	18-24	25-34	35-44	45-54	55-64	65+
Caused by natural processes, either mainly or entirely	2 (1.23%)	2 (1.32%)	4 (3.48%)	10 (5.95%)	16 (6.96%)	23 (7.62%)
Caused by human processes, either mainly or entirely	71 (43.56%)	81 (53.64%)	55 (47.83%)	68 (40.48%)	93 (40.43%)	103 (34.11%)
Caused by a combination of human and natural processes	87 (53.37%)	61 (40.40%)	45 (39.13%)	85 (50.60%)	113 (49.13%)	154 (50.99%)
Not Required to Answer	2 (1.23%)	7 (4.64%)	10 (8.70%)	4 (2.38%)	8 (3.48%)	19 (6.29%)
Don't Know / Refused	1 (0.61%)	0 (0.00%)	1 (0.87%)	1 (0.60%)	0 (0.00%)	3 (0.99%)
Total	**163**	**151**	**115**	**168**	**230**	**302**
Chi-Square (H & C)	**3.14***	**5.32****	**1.77**	**3.47***	**3.52***	**17.62*****

Gold = The Most Popular Choice For That Age Group; * = Significant at the 90 per cent significance; ** = Significant at the 95 per cent significance; * = Significant at the 99 per cent significance; H & C = 'Human Processes' and 'Combination of Human and Natural Processes' respectively**

Source: Author

Table 5.6 – Cause of the current change in the climate by age group in 2019

Response	18-24	25-34	35-44	45-54	55-64	65+
Caused by natural processes, either mainly or entirely	3 (0.75%)	2 (0.69%)	5 (1.92%)	2 (0.66%)	10 (3.65%)	8 (4.71%)
Caused by human processes, either mainly or entirely	207 (52.01%)	143 (49.14%)	126 (48.46%)	148 (49.17%)	128 (46.72%)	76 (44.71%)
Caused by a combination of human and natural processes	187 (46.98%)	143 (49.14%)	123 (47.31%)	139 (46.18%)	125 (45.62%)	80 (47.06%)
Not Required to Answer	1 (0.25%)	2 (0.69%)	5 (1.92%)	6 (1.99%)	8 (2.92%)	4 (2.35%)
Don't Know / Refused	0 (0.00%)	1 (0.34%)	1 (0.38%)	6 (1.99%)	3 (1.09%)	2 (1.18%)
Total	**398**	**291**	**260**	**301**	**274**	**170**
Chi-Square (H&C)	**2.01**	**0**	**0.07**	**0.54**	**0.07**	**0.19**

Gold = The Most Popular Choose for That Age Group; H & C = 'Human Processes' and 'Combination of Human and Natural Processes' respectively

Source: Author

To further explore these differences between age groups over time, the BEIS datasets between 2013 and 2020 were analysed; with two age groups, 16-24 and 25+ as shown in Figure 5.4. It can be observed that there is an 8.9 per cent increase [31.4 to 39.3 per cent] in the proportion of 16-24 year olds that believe that human activity is the cause of climate change. As a consequence there is a significant difference between the proportion of 16-24 year olds that believe it is mostly due to anthropogenic activity between 2013 and 2020, at the 90 per cent level of significance ($\chi2=3.640$, $p=0.056$*). However, the proportion of respondents that are 25 and older that believe climate change is due to human activity rose at a much more modest rate of 2.8 per cent over the same period. This seems to suggest that young people are increasingly more likely to be putting an emphasis on current climate change being due to the activity of humans. Whilst it is difficult to confidently attribute the actual reason for this, there are some potential explanations.

Firstly, it could be due to student education. As mentioned earlier, previous research has shown that some teachers are refusing to teach the natural processes that might influence climate change due to the risk of confusing students. This issue was demonstrated by Interviewer 1 [18-24, Female, Scotland] who recalled an incident when learning about climate change in class, when "another student asked about the natural climate change, the teacher was highly dismissive and said that it was all due to humans". Whilst there is currently no data available about the number of teachers that are engaging in this practice for their teaching about climate change, it is evident that it is happening.

The second potential reason is due to a narrative that is learnt from the media. The early 2010s was an era for climate change that emerged in scandal and controversy with 'climategate' and mistakes being made within the IPCC reports (Boykoff, 2011), as explored in detail in Section 3.3.3. In the intervening period, the media attention has again become focussed on the human activity that is driving climate change, therefore promoting this notion. Also, since roughly late 2018, there has been attention raised about how humans are altering the climate through the climate school strikes around the world (Crouch, 2018; Carrington, 2019), with particular attention to the speeches by Swedish Teenage climate activist Greta Thunberg (Chasan and Wainer, 2019). As demonstrated in the timeframe of Figure 5.4 this was around the same period as the largest increase in belief that human activity was the cause of climate change amongst the youngest in British society. Chapter Seven will further explore British civil society's perception and attitude towards this movement.

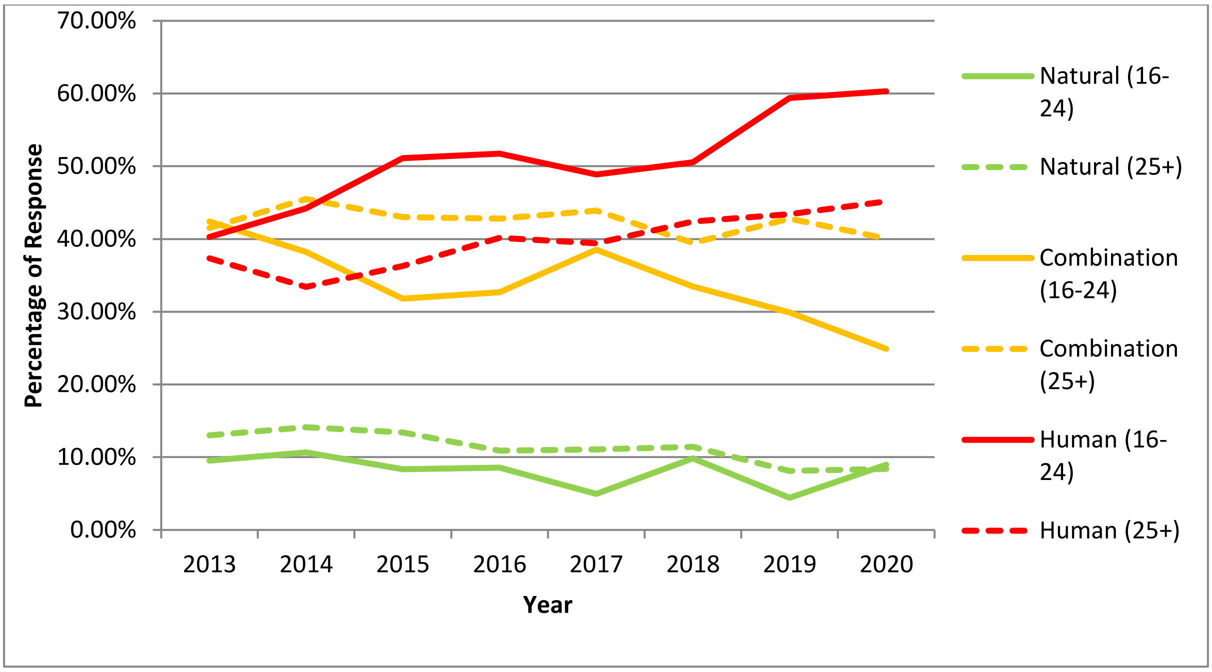


Figure 5.4 – Belief in the cause of climate change between March 2013 and March 2020 for 16-24 year olds and 25+

Source: See Appendix Y for Full Details

Whilst the undercurrent theme of this thesis is youth and climate change, it is important to examine other socio-factors which also might be impacting on differing perception of climate change. The following sub-section will briefly explore these factors in turn.

5.3.2. Other Socio-Factors Influencing Differing Perception of Climate Change

As highlighted throughout Chapter Three, there are socio-economic factors that can influence perception towards climate change. This can be examined further by exploring the Wave 29 [March 2019] of the BEIS Public Attitudes Trackers. This dataset was selected as the vast sample size allows for a comprehensive socio-economic review of young people. A breakdown of the results is shown in Table 5.7.

In terms of gender, females seemed more likely to believe that there is no such thing as climate change or that it is due predominantly due to natural processes than their male counterparts [7.2 per cent for females compared to 5.5 per cent for males]; but there is no significant difference between the two genders ($\chi2=0.587$, $p=0.443$). Whilst there is a 2.9 per cent difference, the 'don't know / no opinion' option is skewing the data.

In terms of ethnicity, the results demonstrate that whilst proportionally there are fewer younger people that believe there is no climate change, there are more young BAME respondents that believe climate change is due to natural processes. As demonstrated further in Appendix Y there is a similar trend that can be observed for the wider BAME community within the United Kingdom, though it should be noted that this difference is not significant ($\chi 2=0.124$, $p=0.724$). If this would be a more significant difference it could be viewed as somewhat surprising, as it has been noted in past research that the BAME community are currently the mostly likely to be vulnerable to disasters within developed countries such as the United Kingdom (Fothergill, Maestas and Darlington, 1999), including in climate change events; and being a scenario also borne out during the COVID-19 pandemic (PHE, 2020). A similar type of trend was observed within the United States by Krogstad (2015) in 2014, who noticed that those of black ethnicity were more likely to believe in natural processes compared to white counterparts [26 per cent versus 22 per cent].

Within social groups, it was found that amongst young people there is a significant difference between the highest social class group 'AB' and the lowest 'DE' who believe either climate change is natural or do not think there is a such a thing as climate change ($p=0.048$**). This difference between the two social classes is further significant at the 99 per cent level for the age groups 25+ ($\chi 2=23.111$, $p=0.000$***). Social class group 'DE' are typically those who are either unskilled workers and/or receiving financial support from the state. Consequently, in the event of disasters associated with extreme events, they are the more vulnerable in society, as they have no additional financial support behind them. That those considered more vulnerable people in contexts of climate change are least likely to believe in anthropogenic climate change is a further demonstration that perceptions on the basis of class is also important.

In summary, the data suggests that for young people (16-24 year olds):

- Those who are female, white, live in an urban area, and from social group DE are the most likely to believe that climate change is not real.
- Those who are female, BAME ethnicity, live in an urban area, and of social grade DE, are the most likely to believe that climate change is due to natural processes.

These contrast to all other age groups, for which:

- Those who are male, BAME ethnicity, live in an urban area, are from a household income group / social grade DE, are the most likely to believe that climate change is not real.
- Those who are male, BAME ethnicity, live in a rural area, are from a household income group / social grade DE, are the most likely to believe that climate change is due to natural processes.

Table 5.7 – Belief in the cause of climate change amongst different socio groups for 16 to 24 year olds, March 2019

		Caused by natural processes, either mainly or entirely	Caused by human processes, either mainly or entirely	Caused by a combination of human and natural processes	*Don't Think There is such a thing as Climate Change*	*Don't Know / No Opinion*	**Total**	**Chi-Square significance (H&C) compared to other age groups**
Gender	Female	12 (5.1%)	60 (25.3%)	153 (64.6%)	5 (2.1%)	7 (3.0%)	**237**	p=0.141
	Male	9 (3.8%)	82 (34.5%)	129 (54.2%)	4 (1.7%)	14 (5.9%)	**238**	p=0.264
Ethnicity	White	13 (3.4%)	118 (30.4%)	232 (59.9%)	9 (2.3%)	16 (4.1%)	**388**	p=0.996
	BAME	8 (9.5%)	22 (26.2%)	50 (59.5%)	0 (0.0%)	4 (4.8%)	**84**	p=0.599
Area Type	Urban	19 (4.8%)	116 (29.2%)	235 (59.2%)	6 (1.5%)	21 (5.3%)	**397**	p=0.170
	Rural	2 (2.6%)	26 (33.3%)	47 (60.3%)	3 (3.8%)	0 (0.0%)	**78**	p=0.110
Social Group	AB	0 (0.0%)	13 (34.2%)	25 (65.8%)	0 (0.0%)	0 (0.0%)	**38**	p=0.105
	C1	8 (4.8%)	40 (23.8%)	114 (67.9%)	1 (0.6%)	5 (3.0%)	**168**	p=0.647
	C2	3 (3.1%)	33 (33.7%)	57 (58.2%)	2 (2.0%)	3 (3.1%)	**98**	p=0.977
	DE	10 (5.8%)	56 (32.7%)	86 (50.3%)	6 (3.5%)	13 (7.6%)	**171**	p=0.410

H & C = 'Human Processes' and 'Combination of Human and Natural Processes' respectively; BAME = Black, Asian and Minority Ethnic; AB = upper middle class and middle class; C1 = lower middle class; C2 = skilled working class; DE = working class and non-working.

Source: Data Adapted from BEIS (2019b)

Both Table 5.7 and previous summaries demonstrate that there are some differences between young people and the other age groups. The most noticeable difference is that females in the youngest age group are the most sceptical and/or denialist of anthropogenic climate change compared to the rest of the population.

The breakdown of responses within different regions as well as income groups within the United Kingdom, for the age group of 16-24 year olds, could not be extracted due to the low numbers of respondents within certain areas; however a breakdown of data sufficient to contrast regions for all ages together is available in Appendix Y. Regional differences for all ages from the survey examined together are demonstrated in Table 5.8.

Table 5.8 shows that the three most sceptical areas within the United Kingdom regards anthropogenic climate change according to the respondents are West Midlands, East of England and Wales at 13.2, 12.3 and 11.7 per cent respectively; compared to the two lowest, which are South West England and South East England at 6.1 and 6.7 per cent, respectively. This suggests that beliefs in climate change are identified with some localised difference. There is, for example a demonstrated significant difference at the 99 per cent level between West Midlands and the South West England ($\chi 2=10.671$, $p=0.001$***).

In terms of income group, a similar trend can be observed with a general trend that those with less income are the most sceptical about climate change. As highlighted earlier in this section, these are the people that are often demonstrated to be, the most vulnerable to the impacts of climate change.

Table 5.8 - Overall belief in the cause of climate change for different regions and income groups within the United Kingdom, March 2019

		Caused by natural processes, either mainly or entirely	Caused by human processes, either mainly or entirely	Caused by a combination of human and natural processes	*Don’ t think there is such a thing as Climate*	*Don’ t Know / No Opinion*	**Total**
Region	North East England	18 (9.6%)	72 (38.3%)	92 (48.9%)	1 (0.5%)	5 (2.7%)	**188**
	North West England	44 (8.8%)	161 (32.3%)	262 (52.5%)	14 (2.8%)	18 (3.6%)	**499**
	Yorkshire and the Humber	32 (8.9%)	168 (46.5%)	147 (40.7%)	4 (1.1%)	10 (2.8%)	**361**
	East Midlands	24 (7.9%)	156 (51.5%)	107 (35.3%)	11 (3.6%)	5 (1.7%)	**303**
	West Midlands	43 (11.6%)	160 (43.2%)	156 (42.2%)	6 (1.6%)	5 (1.4%)	**370**
	East of England	30 (8.2%)	144 (39.2%)	161 (43.9%)	15 (4.1%)	17 (4.6%)	**367**
	London	36 (6.9%)	205 (39.6%)	228 (44.0%)	19 (3.7%)	30 (5.8%)	**518**
	South East England	33 (5.8%)	255 (44.5%)	256 (44.7%)	5 (0.9%)	24 (4.2%)	**573**
	South West England	18 (5.2%)	128 (36.7%)	192 (55.0%)	3 (0.9%)	8 (2.3%)	**349**
	Wales	21 (10.3%)	88 (43.1%)	87 (42.6%)	3 (1.5%)	5 (2.5%)	**204**
	Scotland	22 (5.9%)	170 (45.8%)	151 (40.7%)	8 (2.2%)	20 (5.4%)	**371**
	Northern Ireland	4 (3.3%)	40 (33.1%)	71 (58.7%)	6 (5.0%)	0 (0.0%)	**121**
Income Groups	< £16,000	57 (9.6%)	361 (40.0%)	381 (42.2%)	31 (3.4%)	42 (4.7%)	**902**
	£16,000-£24,999	44 (8.3%)	230 (43.3%)	244 (46.0%)	8 (1.5%)	5 (0.9%)	**531**
	£25,000-£34,999	23 (5.6%)	160 (39.0%)	214 (52.2%)	9 (2.2%)	4 (1.0%)	**410**
	£35,000-£49,999	29 (8.1%)	148 (41.1%)	176 (48.9%)	5 (1.4%)	2 (0.6%)	**360**
	> £49,999	13 (3.8%)	119 (34.6%)	209 (60.8%)	1 (0.3%)	2 (0.6%)	**344**

Source: Data Adapted from BEIS (2019b)

5.3.3. Perceptions on the Change

This section so far has highlighted that there are still some people within the British populace that either do not believe that climate change is occurring or that the process is of natural origins. Within the qualitative elements of the surveys, the respondents often went into detail about their responses to explain why they think that it is of natural origins. Three main themes that were often cited relate to: fiscal, conspiracies, other misleading claims and global cooling.

As respondent 'OLA181' highlights; "climate change is a natural process and all this hype is for other companies to get money out of us including the government" [Female, 45-54, Northern Ireland]. This is backed up by respondent 'OLC173' who indicated that; "'climate change' is a natural phenomenon which is hyped up by scientists, government and the media to justify excessive additional taxation." [Male, 65+, South East England]. These two quotes exemplify how some believe climate change is no more than fiscal policy to generate additional taxation for the treasury. This interpretation has previously been identified as a concern by the Grantham Research Institute on Climate Change and the Environment, who highlight that there is distrust, such that climate change is a clandestine way to increase taxation, rather than incentive to reduce emissions (Carattini, Carvalho and Fankhauser, 2017). As highlighted previously in Chapter 3, the United Kingdom has employed taxation methods linked to climate change that have proven to encourage people and companies to reduce their carbon emissions. Levels of support for some of these taxations are explored further later in this chapter.

The second disbelief in climate change according to comments received related to conspiracy and claims, specifically misleading and controversial claims. For example, respondent OLB010 stated that 'credulous public believes big-business conspiracy that climate change is a hoax' [Male, 45-54, North East England]. As highlighted earlier in Chapter 1 and 3, it has previously been reported that misinformation campaigns have been waged against climate change concerns by climate-denier groups and individuals. Examples of these groups are 'Global Warming Policy Foundation' and 'Exxon' (Monbiot, 2006). It is not possible to list all manner of changing climate denial beliefs within this thesis. However, in recent years, due to the escalation of social media, a new style denialism relating to both climate change and science in general is very detectable. Examples are famously provided by Donald Trump who tweeted that "the concept of global warming was created by and for the Chinese in order to make U.S. manufacturing non-competitive" (Trump, 2012, Online). This is an example of a conspiracy claim about climate change, which will have been seen by millions of Twitter users and has been reported by numerous new reports in the intervening years, giving this conspiracy claim large exposure.

These types of conspiracies are not mentioned in Mann's (2013) six stage of denial. However, Hoofnagle (2009) had a different take on science denial indicating the following five types:

1. The use of forceful statements to subdue the truth. Note that the Trump tweet from the previous paragraph is a clear example of this.
2. Being selective of the data. An example of this is when climate sceptics (Eastbrook, Oliver and Carter, 2013) state that global temperatures for most of the last 10,000 years have been warmer than they are presently based on work by Alley (2000). However, the last recorded temperature was from 1855, and when the temperatures since then are included, results show that current temperatures are above much of the past 10,000 years.
3. The use of fake experts. An example of this occurred last year, when a letter by self-proclaimed 'prominent scientists' sent a letter to António Guterres, the UN Secretary-General stating that there is no climate emergency. When observing the list, most had a history of climate denialism and little to no expertise in climate change science (Walker and Leviston, 2019).
4. Either moving the goalposts on expectations or having implausible expectations. This is when denialists refuse to concede when their challenges have been addressed by climate scientists and start making new claims.
5. Logical paradox. This has been seen numerous times in the news in recent years along the lines of Betz (2020) who called out a number of royal family members and celebrities who have used private jets as 'hypocrites'.

In addition to these arguments, there are some whose scepticism about climate change is due to their historical engagement with the issue being earlier related to global cooling. This is demonstrated with respondent 'OLC173' who recalls that they are "old enough to remember when we were being told that we would all have to move to the Sahara because of the new 'ice age'" [Male, 65+, South East England]. This perception about climate change has its origins in the 1970s, when there were stories within the media, especially within the United States, leading the public to the belief that the climate was cooling. Some examples of these are shown in Table 5.9. This occurred despite growing scientific research at the time, that greenhouse gas emissions were causing the temperature to raise.

Table 5.9 – List of global cooling news in the 1970s

Headline	Publication	Reference
"Colder Winters Held Dawn of New Ice Age: Scientists See Ice Age In the Future"	Washington Post 11th January 1970	Boldt (1970, p. A1)
"Science: Another Ice Age?"	Time Magazine 13th November 1972	Time Magazine (1972, Online)
"Scientists Ask Why World Climate Is Changing; Major Cooling May Be Ahead: Scientists Ponder Why World's Climate Is Changing; a Major Cooling Widely Considered to Be Inevitable"	New York Times 21st May 1975	Sullivan (1975a, p. 92)
"WARMING TREND SEEN IN CLIMATE: Two Articles Counter View That Cold Period Is Due"	New York Times 14th August 1975	Sullivan (1975b, p. 24)

Source: Author

The former climate cooling alert leads to some older respondents' scepticism about current concerns as they are more likely to believe that climate change is natural due to having seen the media discussing global cooling and then global warming. This aside, and despite the overwhelming consensus on climate change as currently known about more comprehensively, there are still stories in the media that try to promote the natural phenomena and/or global cooling. Examples of these for the past ten years are demonstrated within Table 5.10.

However, overall, it can be observed within this sub-section of the thesis, that most of the public do agree that climate change is happening and that it due to anthropogenic activity. Therefore, it is pertinent to this thesis to consider whether the public in the United Kingdom think that the impacts of climate change are a long-distance concept, or a *hic et nunc* plight.

Table 5.10 – Example news since 2010 that could have been attributed to global cooling

Headline	Publication	Reference
"The mini ice age starts here"	Daily Mail 9th January 2010	Rose (2010, Online)
"Dawn of a new ice age"	Daily Express 21st December 2010	Warren (2010, Online)
"So much for global warming as Planet Earth gets colder"	Daily Express 5th July 2011	Ingham (2011, Online)
"Britain faces a mini 'ice age'"	Daily Express 10th October 2011	Caroe (2011, Online)
"And now it's global COOLING! Return of Arctic ice cap as it grows by 29% in a year"	Daily Mail 8th September 2013	Rose (2013b, Online)
"Scientists warn the sun will 'go to sleep' in 2030 and could cause temperatures to plummet"	Daily Mail 10th July 2015	Prigg (2015, Online)
"Earth heading for 'mini ice age' within 15 years"	Daily Mail 11th July 2015	Hyde (2015, Online)
"World is on brink of new ice age and Britain could be hit the hardest"	Daily Mirror 16th October 2015	Carr (2015, Online)
"GLOBAL COOLING: Decade long ice age predicted as sun 'hibernates'"	Daily Express 1st December 2015	Austin (2015, Online)
"Freak climate changes could spark 'mini ice-age' in Britain from 2017"	Daily Express 13th August 2016	O'Brien (2016, Online)
"Three decade ICE AGE to freeze Earth from 2030 – scientist make '97% accurate' prediction"	Daily Star 27th October 2016	Nevett (2016, Online)
"Plummeting temperatures could send the world into a 'mini ice age' in 2030 and could OVERRIDE global warming, claim mathematicians"	Daily Mail 27th December 2017	Weston (2017, Online)
"Could we face a mini ice age in the next 30 years? Scientists make extraordinary prediction based on the sun's natural cycles…and it would even reverse global warming!"	Daily Mail 1st January 2018	Naish (2018, Online)
"'Mini ice age' on Earth could cause -50C temperatures and food shortage, experts warn"	Daily Star 2nd February 2020	Taylor (2020, Online)

5.4. Impacts of Climate Change within the United Kingdom

As reported extensively within chapter two and the latest IPCC reports, there is going to be extensive changes in the climate of the United Kingdom in the forthcoming years (EA, 2018; Lowe *et al.*, 2018; Brown, 2020). However, it is questionable whether the British public are aware of the changes to both the natural environment and humanity sufficiently to be able to best adapt to the changing conditions.

To determine overall views of the British regarding their beliefs about the impact of climate change impacts on the British public, those surveyed in BEIS wave 29 [March 2019] and 33 [March 2020] were asked to describe their "views about the impact of climate change in the UK?". The questions included four main options ranging from climate change as already having an impact within the United Kingdom, to those who believe that climate change is happening but will not have an impact within the United Kingdom. Figure 5.5 demonstrates that most of the respondents believe that climate change is having an impact now, and this has increased by 0.5 per cent between March 2019 and March 2020; however, albeit the increase over this short period is not significant ($\chi2=0.125$, $p=0.724$). The small rise in perception that climate change is already having an impact within the United Kingdom is likely due to the extreme weather between March 2019 and March 2020. This included the unprecedented heatwave that affected the United Kingdom in late July and the severe winter flooding affecting England and Wales between November and February, which culminated in the wettest February in at least 250 years (Met Office, No Date b).

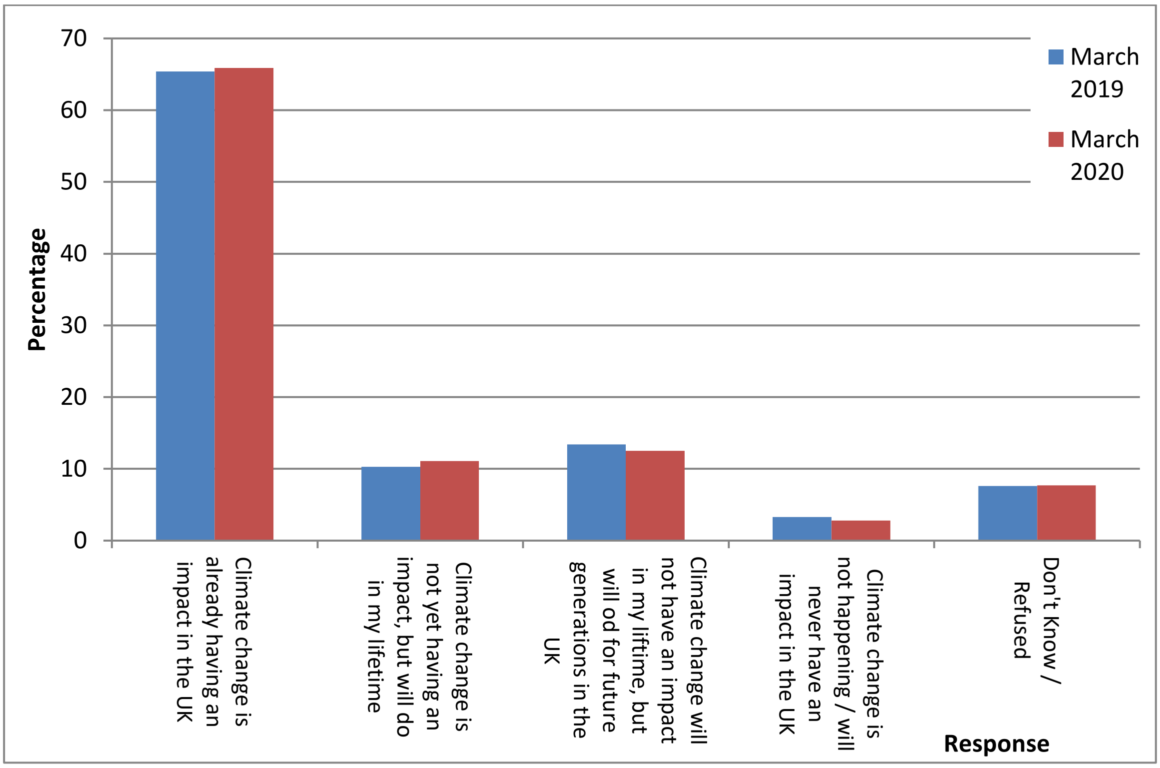


Figure 5.5 – Overall belief of whether climate change is already impacting the United Kingdom in March 2019 and March 2020. **Full Data Breakdown is Available in Appendix Y.**

These results are potentially embedded with three facets. The first is that the public are likely to be more associated with the older generation's observations of changes in the meteorological conditions in their local area over their lifetime. This has been observed by respondent OLC424 who believed that "the weather has changed over the period of my life, from expecting hard cold winters such as 1947 to very mild winters with little extreme cold weather" [Female, 65+, North East of England]. This quote demonstrates that the respondent feels that the winters are becoming increasingly milder. However, it might be the case that what this author would argue is "snow nostalgia". This is when an extreme weather event is experienced by an individual, the way it is perceived and understood being stored within their memory or in the community as a whole (Hassan, 2000). These events can play a powerful role in shaping the memory of events (Forgas, Goldenberg and Unkelbach, 2009; Pillat, 2012). In this case of winter, with cold temperatures and snowfall usually automatically associated with this season, it can be argued that experiencing these weather events, especially when young, can make an individual benchmark future winters to these conditions (Hall and Enfield, 2016). This is demonstrated in the part of the quote "expecting hard cold winters", which seems to suggest that every or nearly every winter during that period had either extreme cold conditions or heavy snowfall. But this was not the case as the winter following in 1947-1948 was normal to above normal in terms of temperature, with little snowfall during that month (Met Office, 1948a; Met Office 1948b). This is not to say that they do not perceive a real change in the climate of the winter months becoming warmer. As demonstrated in Chapter Three, winter months have become milder and wetter (Otto *et al.*, 2018). However, as for the case of "snow nostalgia" theory applied to the older generation, at some point in the future, maybe similar references will be made to winters of 2017-18[43] by the current young generation.

Other respondents looked at a wider range of seasons, and some of the respondents stated that the seasons are starting to become increasingly blended. This has for example been remarked upon by an elderly respondent OLC221, who stated that "over the last 30 years, you can never tell what season it is, other than the day light!" [Male, 65+, North West England]. In addition, respondent OLE018 also stated that "now we have non seasonal weather at any given time of year" and went on to say that "nobody would be surprised if a snow blizzard happened in July" [Male, 45-54, Isle of Man]. Whilst this is a facetious remark, it does highlight that increasingly some people are perceiving that the traditional seasons of the British weather are becoming harder to tell apart from each other. This could because some winter days in recent years have been very mild for the time of the year. An example of this was observed in February 2019, when a day temperature was recorded in Kew Gardens of 21.2^{o}C (BBC, 2019d), which is 12.5^{o}C above the average maximum day temperature and was slightly warmer than the average temperature for June (Met Office, No Date C).

[43] - This winter was synonymous with the 'Beast from the East', which resulted in widespread heavy snowfall and unusual temperatures in both February and March for both the United Kingdom and most of Europe.

The second facet is that of observation of extreme meteorological conditions either in their own local area or as observed in both traditional and social media. This has been demonstrated by respondent OLA019 who stated that the "real life experience of extreme weather events provide[d] evidence to support science-based claims [about climate change]" [Male, 18-24, East of England]. This feeling is backed up by respondent OLA174 who stated that "flooding of the local town just reinstated in my mind how real the threat is" [Male, 18-24, Wales]. These two quotes and for many who have been impacted by extreme weather events in recent years serves as a reminder that climate change is a threat to their community and/or a nation. It is arguable that this is a type of experiential learning, as the respondents that are experiencing extreme methodological events are being taught about just how extreme the weather can and is likely to be in the local community in the forthcoming years. It should be noted that this type of learning is not just for individuals and local communities, but it also can be for governments and for both category 1 and 2 responders[44]. This is demonstrated in the aftermath of the 2003 European heatwave, which resulted in the death of over 2,000 people due to the prolonged extreme heat (Bhattacharya, 2003). Despite the temperatures being warmer in 2019, it is estimated that this event resulted in fewer than 900 deaths (Carrington, 2020; Osborne, 2020). It is likely that both individuals and organisations have acknowledged the potential impacts of climate change and have engaged with the issue to best adapt to the changing conditions as now experienced. In addition, with more international travel, it is increasingly likely that people travel to places that are still rebuilding after an extreme meteorological event. This was the case for respondent OLA134 who stated that they "have travelled to countries where the impact is obvious" [Male, 45-54, Yorkshire and the Humber].

The final facet is that of been told by the media, experts and/or the education sector about the impact that climate change is having within the United Kingdom. This is highlighted by respondent OLB011 who stated that in their life span they "have seen more frequent occurrence of extreme weather in the UK" [Male, 45-54, Isle of Man]. This respondent highlights the change within the United Kingdom as a whole, and as viewed via the media. Another respondent used facts they had recalled about local extreme meteorological events to justify their belief that the United Kingdom is already experiencing the impacts of climate change. Respondent OLD274 stated with regards to major floods in Woking

[44] - Category 1 and 2 responders are defined within the Civil Contingencies Act 2004. Category 1 are the main responders and includes the local authorities, all the emergency services (including NHS trusts) and the Environment Agency. Whereas category 2 are the utility companies (including telecommunications) and transportation.

that “have been 1927and 1968/9 (41 year gap), 2002/3 (34 year gap), 2005/6 (3 year gap) and 2013 (8 year gap)” and are “clearly becoming more frequent” [Female, 45-54, South East England].

So far, this sub-section has highlighted whether people in Britain believe climate change is already having an impact on the United Kingdom. However, this needs to be built upon with an understanding of the different types of impacts that they have in mind. The next sub-sections examine what the public believe has already happened in recent years and then what climate change impacts the public believe are going to happen in future. This draws on data from the BEIS dataset, taken in 2019 and 2020, and the first of the thesis questionnaires for 2017.

5.4.1. Current Impacts of Climate Change within the United Kingdom

Whilst most scientists agree that one direct extreme weather event cannot be attributed to climate change, an overall trend in a series of similar extreme weather events, such as flooding, can be (Schiermeier, 2011). The respondents of the BEIS public attitudes survey were asked “how much, if at all, do you think climate change is currently affecting people in: your local area, people in the UK as a whole, and people in other countries”, and were given the option of “a great deal”, “to some extent”, “not too much”, and “not at all”, the results being those shown in Figure 5.6.

It can be observed from Figure 5.6 that overall, the respondents are more likely to believe that the climate change in other countries contrasts with that of the United Kingdom to “a great deal”, and this has increased by 4.2 per cent in the year intervening period. This difference is significant at the 99 per cent level ($\chi2=9.006$, $p=0.003$***). This is likely due to the impact of severe weather that had been shown in the media, especially that of the wildfires that severely impacted another high economic income country (Australia) in late 2019 and early 2020.

At the United Kingdom level, 25.3 per cent of respondents thought the impact of climate change was occurring a great deal and a further 53.1 per cent that it was to some extent. There was an increase of 11.8 per cent in the ‘a great deal’ response between March 2019 and March 2020. This is the biggest increase of the three areas considered (other countries, UK and local). This increase is significant at the 99 per cent level ($\chi2=9.006$, $p=0.003$***). The increase is again likely due to the extreme weather that occurred in the one-year period between the two surveys; increasing heatwaves that broke the all-time temperatures in the United Kingdom and the severe flooding that affected both England and Wales. However, despite these events, the level of change acknowledged for the local area was less than both the other countries and United Kingdom categories. Arguably this may demonstrate the power of the media in flagging the whole country rather than specific areas that are overall more at risk.

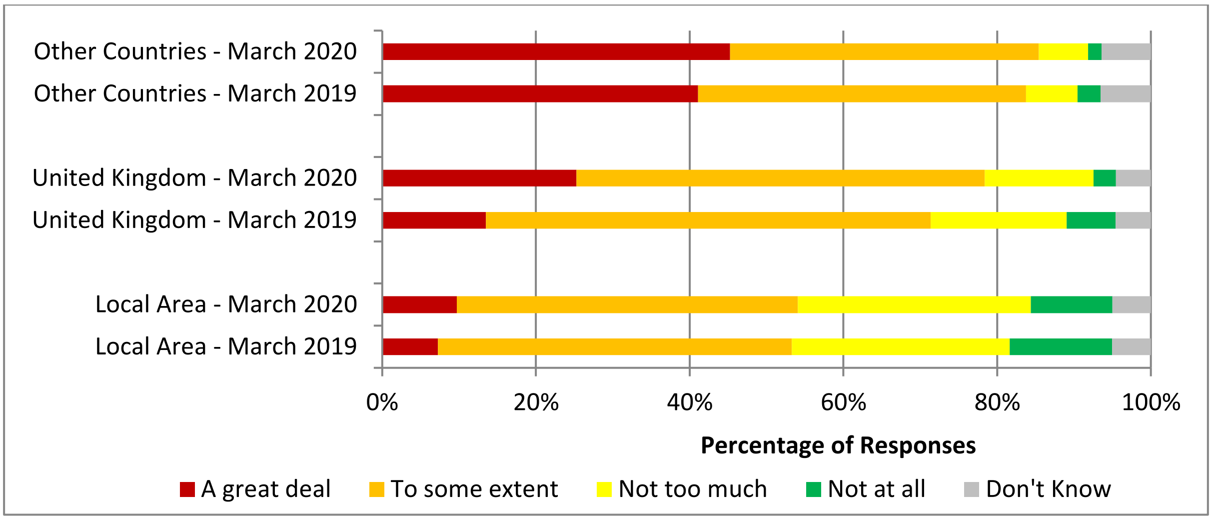


Figure 5.6 – The British public's opinion on how much climate change is currently impacting the climate of their local area, the United Kingdom as a whole and other countries in March 2019 and March 2020

Source: Data Adapted from BEIS (2019b) and BEIS (2020b).

For comparing the different age groups, only the March 2019 is used here, and is shown in Figure 5.7. This is because the March 2020 BEIS survey was cut short due to COVID-19, meaning the sample size is very much smaller for younger people compared to the March 2019 survey. When comparing these results with people of different age groups, it is found that young people are significantly more likely to believe that other countries are already experiencing a greater impacts of climate change ($\chi 2=8.750$, $p=0.003$), with 7.1 per cent difference between the age groups of '16-24' compared to that of '25+'. The difference between the two is smaller for the United Kingdom (5.1 per cent) and within local area categories (1.3 per cent). It is however from this not possible to pinpoint exactly as to why there is a difference between the age groups in this case, especially regards the perspective on 'other countries'.

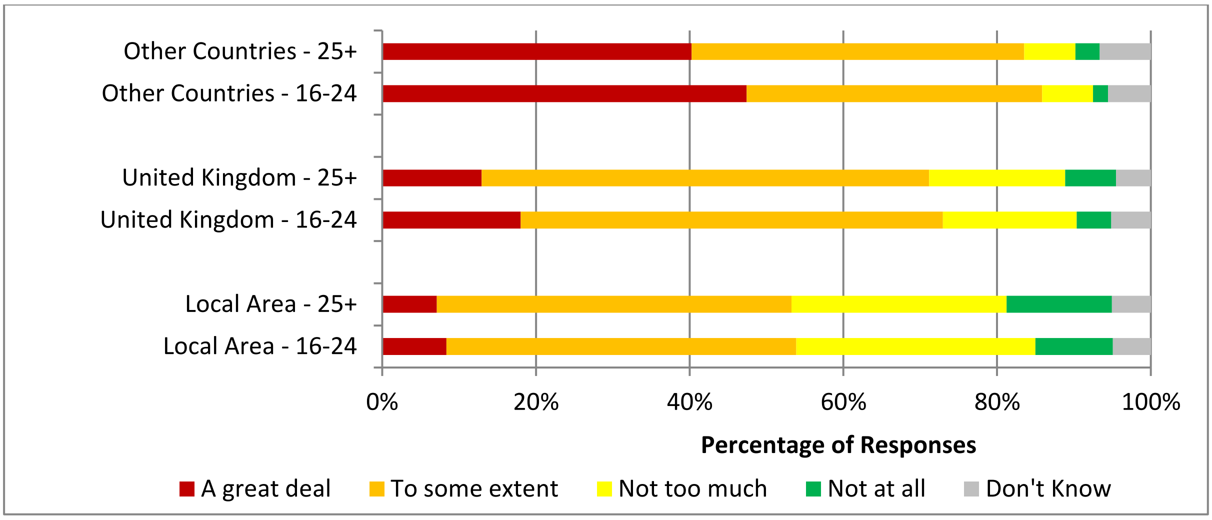


Figure 5.7 – The British public's opinion on how much climate change is currently impacting the climate of their local area, the United Kingdom as a whole and other countries in both March 2019 based upon their age

Source: Data Adapted from BEIS (2019b).

With this indication that respondents are likely to think that climate change is impacting other countries more than the United Kingdom, it is important to determine what current changes respondents have in mind. They were asked whether they have "noticed any impacts of climate change [within the United Kingdom] over the last few years? If so, which ones?". From this, there were eleven different sets of impacts that were recorded. As shown in Figure 5.8, the most popular selection for March 2020 was flooding and rising sea levels, with an increase of 18.9 per cent between March 2019 and 2020. This represents a significant difference between the two periods at the 99 per cent level ($\chi2=207.219$, $p=0.000$***). The increase is likely to be due to the extreme flooding in England and Wales as also suggested from the data in Section 5.4.

Figure 5.9 also demonstrates that there is a 12 per cent decline in respondents who consider that 'rising temperatures / heat / hotter summers' were occurring during this period, also a significant difference at the 99 per cent level ($\chi2=76.355$, $p=0.000$***). This is however somewhat surprising given the summer during that period recorded the United Kingdom's warmest ever recorded temperature.

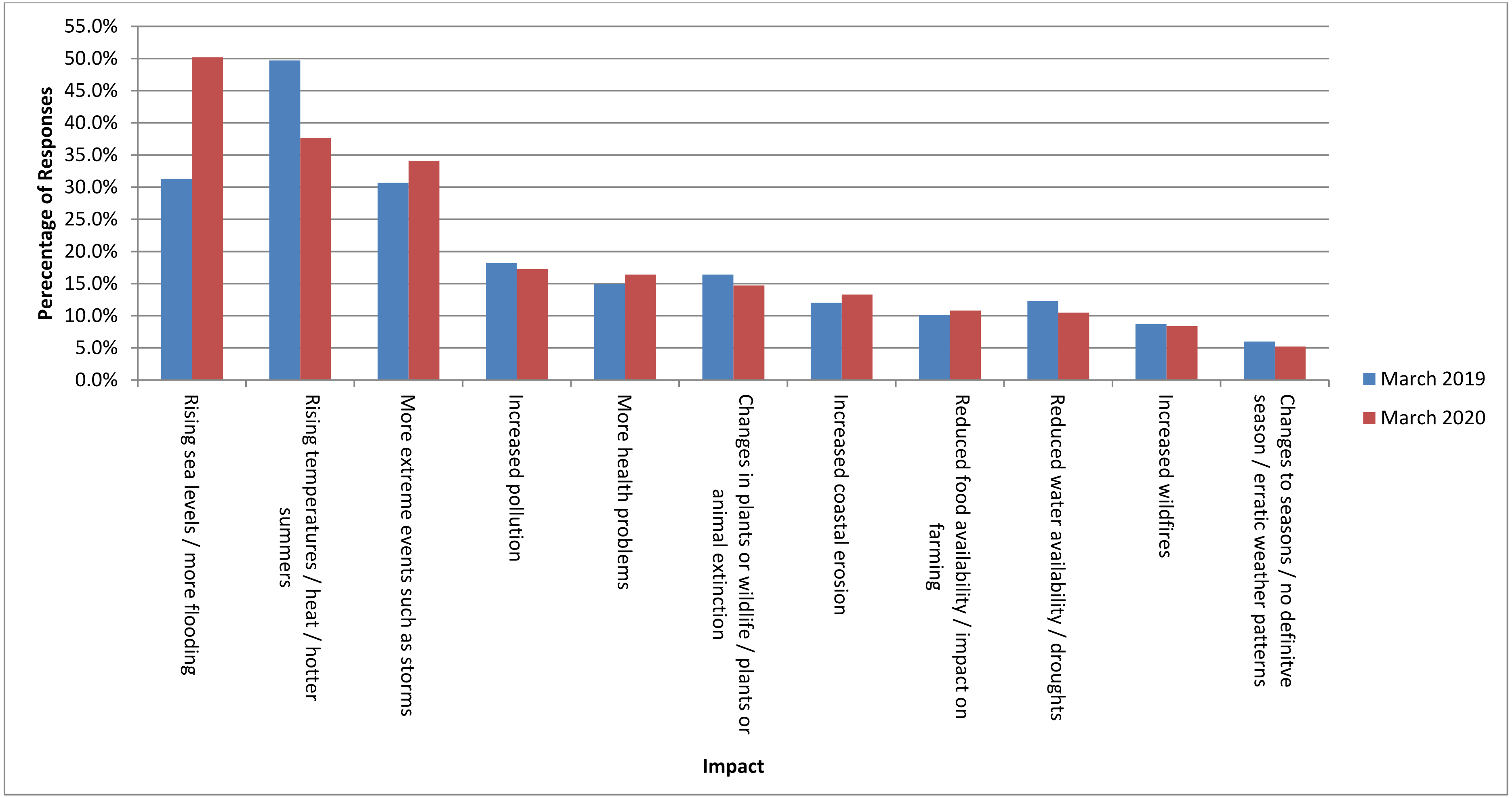


Figure 5.8 – Proportion of respondents indicating differing potential impacts of climate change already impacting the United Kingdom

Source: Data Adapted from BEIS (2019b) and BEIS (2020b). See Appendix Y for full details of the results.

To determine how young people differ in their perception of the current impacts of climate change within the United Kingdom, a further analysis of the Wave 29 [March 2019] of the BEIS dataset was undertaken. The 16-24 age group was separated from the rest of the age groups to determine how much they are different to the other ages groups and whether this difference is significant. Then all the age groups were separated to determine which groups are the most and least likely to believe that the impact was currently occurring within the United Kingdom. These results are demonstrated within Table 5.11.

It can be observed that young people within this dataset were less likely to believe that climate change impacts were currently occurring within the United Kingdom for six of the listed impacts. For two of these impacts, ‘rising sea levels / more flooding’ and ‘changes to seasons / erratic weather patterns’, it was found that the differences with the rest of the age groups were significant at the 95 per cent level. The biggest difference was for the impact of ‘rising sea levels / more flooding’, with 16-24 being 4.4 per cent less likely to believe that this was occurring within the United Kingdom compared to the rest of age groups, and 9.6 per cent less likely compared to the 35-44 age group. Whilst the work carried out as a part of this thesis cannot give a definitive answer as to why young people are significantly less likely to believe that this is happening, it could be that this is because they have been alive for less time and therefore are less aware of this being a recent change compared to previous decades (Stevens, Clarke and Nicholls, 2016). A similar reason could be attributed to the low result for the ‘change of the seasons’ impact compared to the other age groups.

Lastly, it can be observed that both the 16-24 and 65+ age groups were recording the lowest percentages indicating any of the types of impacts. Again, for the ’16-24’ group, this may be due to the potential lack of life experience, meaning that they might not have been observing the change yet. For the case of ‘65+’, they are the least likely to believe climate change is occurring or to worry about the issue, as indicated by the earlier results and had also been observed by other researchers (Ballew *et al.*, 2019b). It is possible that given the nature in the way in which the question was worded, *id est* the inclusion of the term ‘climate change’ may mean that they are less likely to believe that these changes are happening.

In all, only three of the impacts are not significantly different between the groups.

Table 5.11 – Proportion of different age groups that believe impacts on the United Kingdom climate in March 2019

	16-24	25+	Difference		Highest	Lowest	Sig.
Rising sea levels / more flooding	120 25.8%	1106 30.2%	-4.4%	0.048**	35-44 35.2%	16-24 25.8%	0.001***
Reduced food availability / impact on farming	45 9.7%	285 7.8%	+1.9%	0.160	25-34 10.9%	65+ 5.8%	0.003***
Reduced water availability / droughts	44 9.4%	379 10.3%	-0.9%	0.544	45-54 13.0%	65+ 8.6%	0.070**
Changes in plants or wildlife / plants or animal extinction	69 14.8%	529 14.4%	+0.4%	0.833	25-34 16.0%	65+ 13.4%	0.647
More health problems	58 12.4%	475 13.0%	-0.6%	0.752	25-34 17.2%	65+ 8.9%	0.000***
Rising temperatures / heat / hotter summers	242 51.9%	1763 48.1%	+3.8%	0.122	25-34 52.9%	65+ 42.8%	0.000***
More extreme events, such as storms	123 26.4%	1080 29.5%	-3.1%	0.167	55-64 34.1%	16-24 26.4%	0.042**
Increased pollution	90 19.3%	584 15.9%	+3.4%	0.064*	25-34 21.6%	65+ 10.9%	0.000*
Increased wildfires	33 7.1%	238 6.5%	+0.6%	0.632	25-34 7.4%	65+ 5.1%	0.213
Increased coastal erosion	39 8.4%	374 10.2%	-1.8%	0.212	55-64 13.1%	16-24 8.4%	0.015**
Changes to seasons / no definitive seasons / erratic weather patterns	10 2.1%	148 4.0%	-1.9%	0.045**	45-54 4.6%	16-24 2.1%	0.104

*** = Significant at the 90 per cent significance; ** = Significant at the 95 per cent significance; *** = Significant at the 99 per cent significance; Sig. = Significance**

Source: Data Adapted from BEIS (2019b). Full Data Breakdown is Available in Appendix Y.

Table 5.12 summaries the impacts of climate change already going on, as identified the most by the 16 to 24 years olds depending on their differing social group category. It shows that for most of the impacts [8], the social group 'AB' were the most likely to believe they are occurring, and significantly most likely (95 per cent level of significance) to believe that there are more extreme meteorological events occurring within the United Kingdom currently.

The results also demonstrate that females in the most part were likely to believe each of the impacts were occurring; however, there were no significant differences between any of the impacts.

Table 5.12 - ***Socio group, gender, area and ethnicity of 16 - 24 age group with highest numbers believing impacts on the United Kingdom climate, March 2019***

	Social Grade	Gender	Area	Ethnicity
Rising sea levels / more flooding	AB 31.6%	Female 26.9%	Urban 26.3%	Ethnic Minority 31.0%
Reduced food availability / impact on farming	AB 13.2%	Female 9.8%	Urban 9.7%	Ethnic Minority 10.7%
Reduced water availability / droughts	AB 13.2%	Female 9.8%	Urban 10.7%**	Ethnic Minority 15.5%*
Changes in plants or wildlife / plants or animal extinction	AB 18.4%	Female 17.1%	Urban 14.8%	Ethnic Minority 17.9%
More health problems	C1 13.8%	Female 13.2%	Urban 12.5%	Ethnic Minority 13.1%
Rising temperatures / heat / hotter summers	AB 60.5%	Female 53.0%	Rural 56.0%	White 52.8%
More extreme events, such as storms	AB 39.5%**	Female 27.8%	Urban 26.6%	White 27.4%
Increased pollution	AB 26.3%	Male 20.7%	Urban 19.9%	Ethnic Minority 26.2%
Increased wildfires	AB 10.5%	Female 8.5%	Urban 7.9%	*Both* 7.1%
Increased coastal erosion	C1 13.2%**	Male 9.1%	Rural 9.3%	Ethnic Minority 9.5%
Changes to seasons / no definitive seasons / erratic weather patterns	C2 3.1%	Female 2.6%	Rural 4.0%	Ethnic Minority 2.4%

AB = upper middle class and middle class; C1 = lower middle class; C2 = skilled working class; * = Significant at the 90 per cent significance; ** = Significant at the 95 per cent significance.

Source: Data Adapted from BEIS (2019b). Full Data Breakdown is Available in Appendix Y.

In terms of the area in which the respondents live, those who live in an urban area, are in the most part, more likely to believe that impacts of climate change are already impacting compared to their rural counterparts. This is especially so for the 'reduced water availability / droughts' category, as there was a significant difference between the two groups at the 95 per cent level. Albeit this is a further detail for which this thesis cannot truly give a particular explanation, it serves to expose a complexity regarding perceptions of climate change impacts across age, gender and socio-economic status.

Further, a similar significant difference was observed within the ethnicity group, where ethnic minorities were significantly more likely to believe that the United Kingdom had experienced reduced water availability in recent years due to climate change, though only at the 90 per cent level of significance. Meanwhile, there were only two impacts in which white ethnicity are more likely to believe them compared to ethnic minorities. These were the rising temperatures and more extreme weather events categories, though these differences are not statistically significant.

In contrast to findings earlier in this chapter, where the youngest age group in the survey (16-24 group) were the most likely to believe that the impacts of climate change was impacting the United Kingdom 'a great deal' (Figure 5.7), when they were given a different list of impacts, they were regularly the least likely to choose these impacts listed in Table 5.11 and Table 5.12. This may show that they may acknowledge that the impact is already occurring in the United Kingdom as sufficient (Figure 5.7), whereas the older generations overall need more evidence having an expectation that the impacts should be much bigger by now, though they may recognise that they are going to become much larger.

5.4.2. Future Impacts of Climate Change within the United Kingdom

Research within the United States has previously demonstrated that an individual's perception of climate change impacts could have a positive influence in their support for adaptation actions (Singh *et al.*, 2017), but could in some cases create a negative health impact, being termed eco-anxiety (Hügel and Davies, 2020), which was briefly discussed in Chapter 1.1. These types of behaviour for calling action on adaption measures for climate change have been observed when a community has already been affected by an extreme meteorological event. Pielke Jr. *et al.* (2007) highlighted that climate change post-Hurricane Katrina was not focused on mitigating against future impacts but was more about how to build the capacity of the most vulnerable in society to adapt more to present risks that climate change poses than potential future risks. This could have an overall negative impact in combatting climate change. Singh *et al.* (2017) highlight that focusing on climate change impacts and the adaption towards climate change as it occurs, may reduce focus and perceptive need to mitigate against future more uncertain climate change. This then highlights the need to see what future climate change impacts there are likely to be on the British public, medium and long term. Better understanding the risk of future impacts is pertinent, as it will give some discernment as to what the public will need to expect to be done to adapt to these impacts. It might also give an insight into the potential levels of support for mitigation strategies towards climate change presently and in the medium term.

The respondents from the BEIS questionnaire from the previous sub-section were asked “which of these do you think are likely to occur in the UK in the next 15 to 20 years [present until 2035-2040] as a result of climate change?” The respondents were allowed multiple answers. This enabled a comparison between the change in those who think that the impacts are occurring now and those who think that they will occur in the medium-term future. The results for March 2019 and March 2020 are demonstrated within Figure 5.10. These show that in March 2020, respondents indicated the most likely impact of climate change that is going to affect the United Kingdom to be ‘rising sea levels and more flooding’, with 60.6 percent of the respondents having chosen this impact. For March 2019, this impact was only the second most chosen impact, indicating there was a significant 6.9 percent increase during the intervening period ($\chi2=26.045$, $p=0.000$).

Figure 5.10 also demonstrates that in the intervening period between March 2019 and March 2020, perception of eight of the eleven impacts have declined; of which five had varying levels of significant difference between the two dates. None of the changes were as large as for ‘rising temperatures / heat / hotter summers’, as this category declined by 9.3 percent from the most selected potential future impact in March 2019 to the third most in March 2020.

In analysing why these changes are occurring, there are several potential reasons. The first links back to the ‘finite pool of worry’ theory. During the time of the survey in March 2020, as highlighted throughout Section 5.4.1, the United Kingdom had just come out of a major flooding event a couple of weeks previously, especially in Yorkshire, Midlands, South of England and Wales. This could prompt more people to worry about the potential impacts and consequences of flooding and relate it back to climate change. This is further demonstrated in Figure 5.8 when the respondents were asked about the current impacts of flooding, which rose by 18.9 percent. The combination of these two results might be a good indicator that these flooding events were still fresh in their mind.

The other reason for where numbers are in decline for the different impacts might be due to the COVID-19 pandemic. The pandemic may have changed the proportion of responses slightly, as the BEIS stated that results are fieldwork, *id est* consequently slightly different proportions of respondents were being asked. For example, an increased proportion of young people ’16-24’ year old were asked in March 2020 compared March 2019. However, this should not be a major factor in discounting the change as having occurred. Another reason related to COVID-19 is also the 'finite pool of worry', as increasing numbers of COVID-19 were occurring in March 2020, the news reports about potentially how deadly the virus was, and the looming threat of the national lockdown might have been praying on their mind. Consequently, they might not be as focused on climate change and its impacts even when prompted by this survey. It would be useful to continue this observation after the COVID-19 pandemic has subsided to see if these numbers rebound.

The following results and analysis are also extracted from the BEIS (2019b) data from fieldwork carried out in March 2019 as it was important for this thesis to examine the differences between age groups in isolating any varying levels of concern about climate change from young people [16-24]; how these translate to understanding and perception of the potential impacts that are expected to impact in the medium to long-term future of the United Kingdom. A summary of the results is demonstrated in Table 5.13.

It can be observed that for young people [16-24] there are just three impacts that are perceived to be of a lower risk at a significant level (95 per cent level) than the average response for the 25 and over age group. The only one which is at the 99 percent significance level is 'increased coastal erosion', which is 10.3 percent lower than the '25+' age group. Within Table 5.9 a similar trend was observed, though with only a 1.8 percent difference. Overall, the differences between age groups raises questions as to why young people are so much less likely to believe that projected future climate change within the United Kingdom will result in 'increased coastal erosion'. One explanation in this instance is that populations that are most likely to be affected by coastal erosion are the more elderly (Beatty, Fothergill and Wilson, 2011). More elderly people are likely to be in communities under threat or know somebody who is under threat from future increases in coastal erosion. As observed in Table 5.11 and similarly in Table 5.13, the age groups that are most likely to think that certain impacts are not going to impact the United Kingdom in the medium-term are the '16-24' and '65+' groups; except for the 'change to season / no definitive season / erratic weather patterns' category, for which the '25-34' and '55-64' age groups record no responses. However, too few recorded a response for this impact [19] for a valid conclusion to be drawn.

Overall, there are significant differences between the age groups, mainly at the 99 percent significance level. Though there is an increased proportion of the older population that may believe climate change is occurring, its effects are considered only marginable amongst that group in comparison to younger groups.

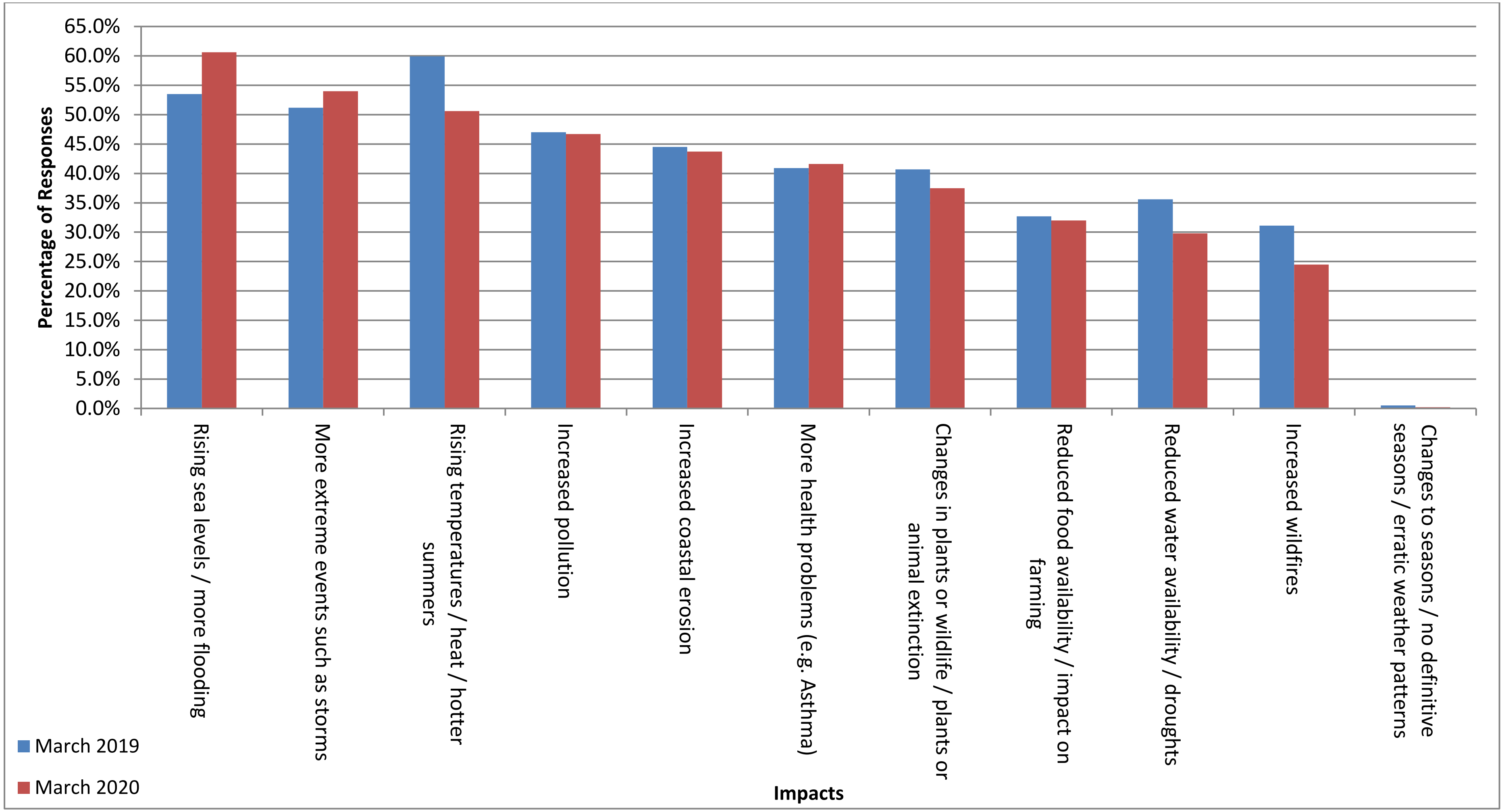


Figure 5.9 - Respondents Differing Perceptions of Potential Impacts of Climate Change Likely to Occur in the Next 15 to 20 Years

Source: Data Adapted from BEIS (2019b) and BEIS (2020b). See Appendix Y for full details of the results.

Table 5.13 – Proportion of different age groups that believe listed climate Impacts will occur in the United Kingdom within the next 15 to 20 Years, March 2019

	16-24	25+	Difference (*p*)		Highest	Lowest	*p*
Rising sea levels / more flooding	241 51.7%	1966 53.7%	- 2.0%	0.425	55-64 59.4%	65+ 49.4%	0.001***
Reduced food availability / impact on farming	158 33.9%	1194 32.6%	+ 1.6%	0.571	35-44 39.4%	65+ 26.5%	0.000***
Reduced water availability / droughts	143 30.7%	1328 36.3%	- 5.6%	0.018**	55-64 42.6%	16-24 30.7%	0.000***
Changes in plants or wildlife / plants or animal extinction	207 44.4%	1472 40.2%	+ 4.2%	0.080*	35-44 46.0%	65+ 33.9%	0.000***
More health problems	187 40.1%	1502 40.1%	0.0%	0.717	35-44 47.2%	65+ 33.9%	0.000***
Rising temperatures / heat / hotter summers	305 65.5%	2167 59.2%	+ 6.3%	0.009***	16-24 65.5%	65+ 54.4%	0.000***
More extreme events, such as storms	215 46.1%	1901 51.9%	- 5.8%	0.019**	45-54 58.4%	16-24 46.1%	0.000***
Increased pollution	247 53.0%	1694 46.2%	+ 6.8%	0.006***	16-24 53.0%	65+ 38.5%	0.000***
Increased wildfires	151 32.4%	1135 31.0%	+ 1.4%	0.534	55-64 36.6%	65+ 28.4%	0.006***
Increased coastal erosion	165 35.4%	1674 45.7%	- 10.3%	0.000***	55-64 50.6%	16-24 35.4%	0.000***
Changes to seasons / no definitive seasons / erratic weather patterns	4 0.9%	15 0.4%	+ 0.5%	0.177	44-54 1.0%	25-34 55-64 0.0%	0.051*

*** = Significant at the 90 percent significance; ** = Significant at the 95 percent significance; *** = Significant at the 99 percent significance; Sig. = Significance**

Source: Data Adapted from BEIS (2019b). Full Data Breakdown is Available in Appendix Y.

Intergenerational differences in perception of impact are explored across social groups as summarised in Table 5.14.

In terms of social grade, either 'AB' or 'C1' were the mostly likely to think climate change impacts are likely to happen. In these cases, most of the responses lead to differing levels of significance differences between the social grades. As demonstrated by the data in more detail in Appendix Y social grade 'C2' and 'DE' for all types of impact are never higher than the highest two social grades ['AB' and 'C1']. Therefore, it can be concluded that social grade can influence a young person's perception of the future impacts of climate change within the United Kingdom. One of the likely explanations is that social grade 'AB' and 'C1' are classed as those who are in supervisory, managerial, and administrative and professional lines of work (NRS, No Date). Consequently, those within the social grade 'AB' and 'C1' are likely to have received some levels of higher education. Past research has shown that those with a higher education background have higher levels of belief in climate change (Clements, 2012; Taylor, Bruine de Bruin and Dessai, 2014).

In general, females are more likely to believe in these future impacts in the United Kingdom. The only impact that males were significantly more likely to believe is going to happen compared to their female counterparts is 'rising temperatures / heat / hotter summers', albeit at the 90 percent significance level. However, the lack of any significant difference between the two genders within the vast majority of future impacts means that an overall conclusion that there is a difference on the basis of gender as well as socio group is not reached from this data.

Similar to gender, area urbanism and ethnicity trends for this forecasting of impact is also a mixed set of results, where area of residence is interchangeable within the cross-analysis. However, regards ethnicity of groups, those who are of white ethnicity are the most likely to perceive these impacts to be occurring in all but three categories.

It should be noted that all impacts that the BEIS chose were based on what the science is telling society as to what is expected to happen in the near to long term future. However, not everybody will believe this. Within the first questionnaire for this research in 2017, the respondents were asked "with future climate change, how do you think the following issues are going to change within the United Kingdom?". To determine overall response to this question, the responses were converted to a Likert scale, with 'lower occurrence' being given a value of '1', 'same rate of occurrence' being given a value of '2', and 'greater occurrence' equal to '3', and the mean calculated. Table 5.15 demonstrates the difference in responses depending on type of climate change impact. The table has been ordered from the most to the least likely using the mean value responses from the Likert Scale.

Table 5.14 - ***Highest proportions of social groups, between the ages of 16 and 24, that believe listed impacts are going to have an impact in the United Kingdom within the next 15 to 20 years***

	Social Grade	**Gender**	**Area**	**Ethnicity**
Rising sea levels / more flooding	AB 65.8%***	Male 52.2%	Urban 52.4%	White 52.8%
Reduced food availability / impact on farming	AB 42.1%	Female 37.2%	Rural 38.7%	White 34.0%
Reduced water availability / droughts	AB 42.1%	Female 31.6%	Rural 33.3%	White 30.9%
Changes in plants or wildlife / plants or animal extinction	C1 55.1%***	Female 51.3%	Urban 44.8%	Ethnic Minority 46.4%
More health problems	AB 44.7%	Female 43.2%	Urban 40.7%	Ethnic Minority 42.9%
Rising temperatures / heat / hotter summers	AB 81.6%**	Male 69.4%*	Rural 73.3%	White 66.2%
More extreme events, such as storms	AB 60.5%***	Female 47.0%	Rural 50.7%	White 46.7%
Increased pollution	AB 71.1%***	Female 55.1%	Rural 53.3%	Ethnic Minority 59.5%
Increased wildfires	AB 44.7%*	Female 36.3%*	Urban 32.5%	White 34.3%*
Increased coastal erosion	C1 43.1%**	Male 37.9%	Rural 41.3%	White 36.7%
Changes to seasons / no definitive seasons / erratic weather patterns	C1 2.4%*	*Same* 0.9%	Urban 1.0%	White 1.1%

AB = upper middle class and middle class; C1 = lower middle class; C2 = skilled working class; * = Significant at the 90 percent significance; ** = Significant at the 95 percent significance.

Source: Data Adapted from BEIS (2019b). Full Data Breakdown is Available in Appendix Y.

Table 5.15 demonstrates that the respondents more frequently believed the most likely occurring impact of climate change in the future within the United Kingdom will be 'flooding' with a mean value of 2.88; only five of the respondents believed that flooding will be become less of a problem in the future due to climate change. Their perception in this instance conforms to the majority of the studies highlighting that flooding is going to become an increasingly common occurrence in the future. For most impacts listed, the respondents are expecting that they will increase at varying levels. The only exception is 'problems with water availability', where most of the respondents believe that it will remain the same.

Table 5.15 – Respondents perception of what impacts will occur within the United Kingdom in the future due to climate change

	Lower Occurrence	Same Rate of Occurrence	Greater Occurrence	Mean
Flooding	5 0.45%	121 10.77%	997 88.78%	**2.88**
Heat Wave	49 4.40%	237 21.29%	827 74.30%	**2.70**
Rainfall	60 5.44%	260 23.57%	783 70.99%	**2.66**
Economic Losses	31 2.82%	340 30.91%	729 66.27%	**2.63**
Poor Air Quality	33 2.97%	343 30.90%	734 66.13%	**2.63**
Crop Losses	49 4.42%	329 29.69%	730 65.88%	**2.61**
Droughts	78 7.05%	272 24.59%	756 68.35%	**2.61**
Wind Storms	22 2.00%	364 33.03%	716 64.97%	**2.63**
Animal Extinctions	67 6.07%	437 39.58%	600 54.35%	**2.48**
Migration	59 5.36%	452 41.05%	590 53.59%	**2.48**
Diseases	58 5.27%	540 49.09%	502 45.64%	**2.40**
Wild Fires	73 6.66%	518 47.26%	505 46.08%	**2.39**
Cold Waves	216 20.04%	375 34.79%	487 45.18%	**2.25**
Snowfall	294 26.92%	365 33.42%	433 39.65%	**2.13**
Problems with Water Availability	293 26.71%	471 42.94%	333 30.36%	**2.04**

***N* = 1,134**

Source: Author

5.5. Perception of Climate Change as a Serious Problem?

The results show that the British public generally think that the United Kingdom is already being impacted by climate change, albeit with varying views on how that has been occurring and how it will occur in the future. This raises the further question as to whether, although they think that it is already happening, do they think that climate change is a serious problem.

The Eurobarometer has been recording how serious a problem civil society across the European Union has viewed climate change between 2008 and 2019. The respondents were asked "how serious a problem do you think climate change is at this moment?". These results were collected using a Likert Scale between 1 and 10 [1= Not at all a serious problem, 10 = An extremely serious problem].

Table 5.16 demonstrates the top five countries overall within the European Union for the levels of how serious civil society in each view climate change for the previous two Eurobarometer surveys in 2017 and 2019. It shows that that for both dates, the United Kingdom has been constantly scoring lower concern scores compared to several other European Union countries. This is demonstrated within the latest Eurobarometer survey from April 2019, which shows that the United Kingdom was seventeenth out of twenty-eight countries, and was averaging a mean score of 1.07 behind Spain, the highest scoring country. This gap is fairly constant, as the gap in 2017 was 1.02; however, the United Kingdom gained seven positions in the intervening period with an expanding heterogeneity in how serious a problem climate change is viewed across the European Union.

Table 5.16 – Top five countries within the European Union and the United Kingdom for 2017 and 2019 in ranking perception of how serious a problem climate change is currently viewed

2017		
	Country	**Mean**
1	Spain	**8.21**
2	Greece	**8.19**
3	Italy	**8.12**
4	France	**8.08**
	Hungary	
24	United Kingdom	**7.19**
-	European Union	**7.59**

2019		
	Country	**Mean**
1	Malta	**8.90**
2	Spain	**8.55**
3	Greece	**8.48**
4	Cyprus	**8.33**
5	Hungary	**8.31**
17	United Kingdom	**7.83**
-	European Union	**7.88**

Source: Data Adapted from Eurobarometer (2017) and Eurobarometer (2019). Full Figures are demonstrated in Appendix D.

The United Kingdom based perception of how serious a problem climate change is currently has not been constant. This is shown in both Table 5.16 and Figure 5.10. Figure 5.10 demonstrates that between 2008 and 2019 there are two main stages to the levels of seriousness that the British respondents had about climate change. The first stage is the decline from the start of the survey in April 2008 to December 2013, where the mean score dropped from 7.01 to 6.09. The next stage is the recovery of the perception score from December 2013, with the score rising from 6.09 to 7.83 in April 2019. This data is consistent with the likelihood of at least two 'social tipping points' in the last decade and half.

Within climate change studies, tipping points are regularly and increasingly talked about in terms of an environmental issue. However, it needs to be analysed as to what way there is an actual social tipping point within climate change studies. Milkoreit *et al.* (2018, p.10) defines social tipping points as "self-reinforcing positive feedback mechanisms, that inevitably and often irreversibly lead to a qualitatively different state of the social system". This thesis provides evidence consistent with this definition, in that data is suggesting the possibility of there being a self-reinforcing feedback mechanism that can be controlled by numerous external focuses, including extreme meteorological events, controversy, activism or media coverage. It demonstrates also that changes in perception are inevitable.

In relation to Figure 5.10, the first tipping point occurred at some point before 2009. Though this is before the available data, this social tipping point of climate change has been observed in numerous previous studies from roughly this time period, when there was an increase in climate scepticism, especially within Australia (Connor and Higginbotham, 2013), Germany (Ratter, Philipp and von Storch, 2012), the United Kingdom (Spence *et al.,* 2010; Corner *et al.,* 2011), and the United States (Shwartz, 2010; Leiserowitz *et al.,* 2014). There have been other studies in recent years that speculate as to why this occurred. The first reason, as highlighted in Section 3.2.2, is due to extremely cold and snowy weather within the United States and Europe (Perkins, 2010; Moser and Dilling, 2011; Capstick and Pidgeon, 2014a). A secondary potential cause was the state of the economy; past research reported by Kahn and Kotchen (2010) demonstrated that higher levels of unemployment have a positive association to lower levels of environmental concerns. This is linked to the 'finite pool of worry' theory as backed up by Weber (2010). However, as highlighted earlier in this chapter, there are some questions as to whether the 'finite pool of worry' effect is strong. Despite the aftermath of Brexit and the economic uncertainty it is bringing, and in addition to the increased number of terrorist attacks within the United Kingdom and Europe as a whole in the mid-2010s, the level of concern with climate, as observed within Figure 5.10, continued to rise following its earlier decline. The third theory was the controversy that surrounded 'climategate', but as demonstrated within Section 3.3.3.2, researchers believed that this impact was only short-lived (Anderegg and Goldsmith, 2014). The final theory is the lower levels of media coverage during that period (Leiserowitz *et al.,* 2013), and Boykoff

(2011) demonstrates that apart from one month in 2009 [which was the time of the Copenhagen COP conference], there was a decline in the amount of media coverage that climate change received in both the United Kingdom and the United States from 2007. This would have an impact, as highlighted within Chapter 3.2. The institutional media has previously been the most important way to disseminate scientific information about climate change. However, while it is becoming less important with the advent of social media, it remains an important tool in communicating climate science with the public.

The current trajectory is suggesting that climate change scepticism is still declining. However, it is unwise to speculate on the future trajectory, as past research has shown that events can play an influential role in forming the national psyche towards climate change perception and therefore its engagement.

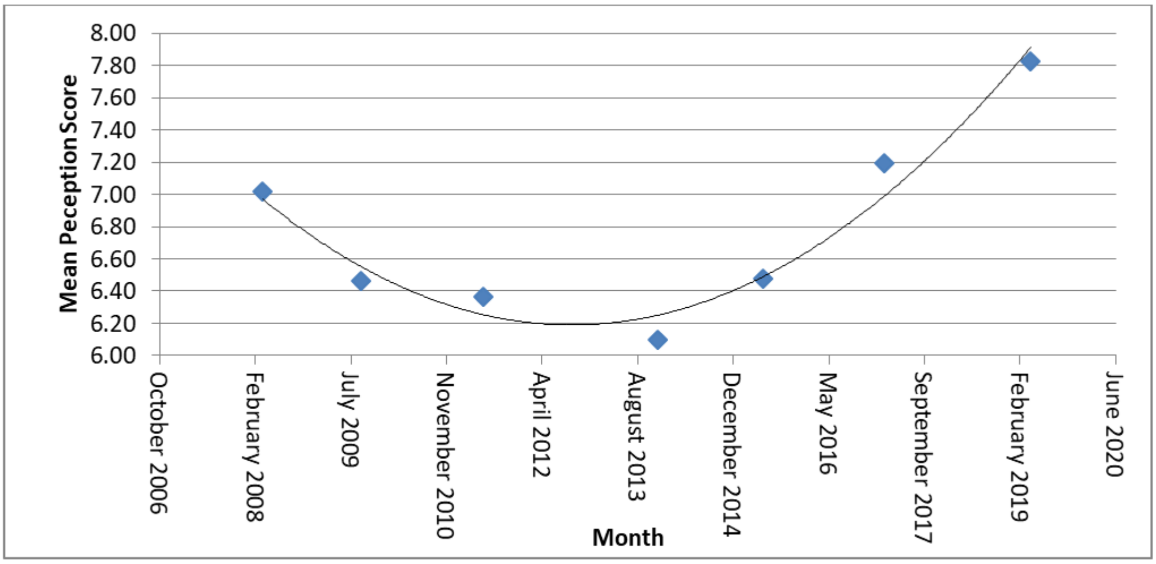


Figure 5.10 – Mean Perception Score for the British Respondents to the question "How Serious a Problem is Climate Change?"

Blue Diamonds = Observation Data; Black line = Trend Line

Source: Data Adapted from Eurobarometer (2008); Eurobarometer (2009); Eurobarometer (2011); Eurobarometer (2013); Eurobarometer (2015); Eurobarometer (2017); Eurobarometer (2019)

As highlighted within Table 5.14, there are apparent major differences in the perception of how serious the public of each nation believe climate change is currently. However, this difference can be more localised within the borders of a country, as so often demonstrated within the United States. Figure 5.11 demonstrates the perception score on the seriousness of climate change using the NUTS1 [Nomenclature d'Unités Territoriales Statistiques] break down of the different regions. It can be observed that within the United Kingdom, there are regions, such as Cornwall and Northern Ireland, which are ranked within the top category within the map of the European Union regards believing that climate change is a serious problem. In contrast, North East of England and 'Yorkshire and the Humber' are ranked much lower and have similar scores to those recorded in Eastern Europe and the most northern extremes of Europe. The striking story that the map tells is the level of differences that can be observed within the map with contrasting regions often next to each other. This highlights that each area has a unique balance of factors that influence perception, and therefore should highlight to the scientific/academic community trying to communicate climate change to the public that a rigid, one approach model would not be successful in trying to get the public more engaged with climate change.

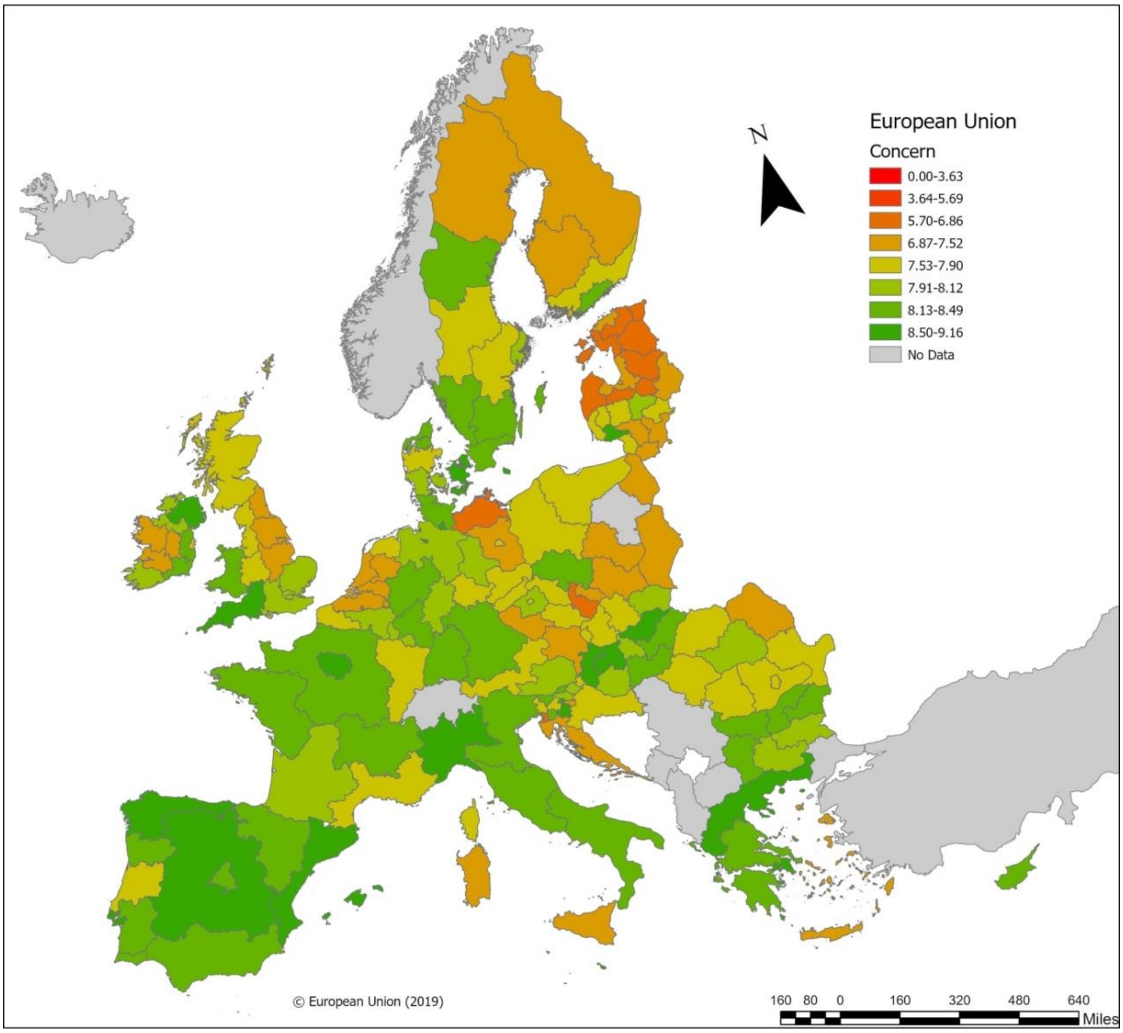


Figure 5.11 – Seriousness of the Climate Change problem as viewed Across the European Union in April 2019 at NUTS1 (Nomenclature d'Unités Territoriales Statistiques) Level

Source: Data Adapted from Eurobarometer (2019)

Figure 5.12 demonstrates the difference in between the age groups between April 2008 and April 2019. The data shows that young people [15-24] have throughout the eleven years period been the third out of the four age groups for concern of climate change within the United Kingdom. This demonstrates whilst young people are concerned about climate change, compared to other age groups they have not constantly viewed it as a serious problem compared to the older counterparts.

The results in Figure 5.12 is constant with the results from the earlier sections of this chapter; that the most elderly respondents within the survey are typically least likely to think that climate change is a serious problem compared to other age groups. However, the reduction observed pre-2013 is not as large compared to other age groups. In addition, the overall divide between the age groups has reduced in recent years, with it now standing at 0.19 compared to 1.32 in April 2008.

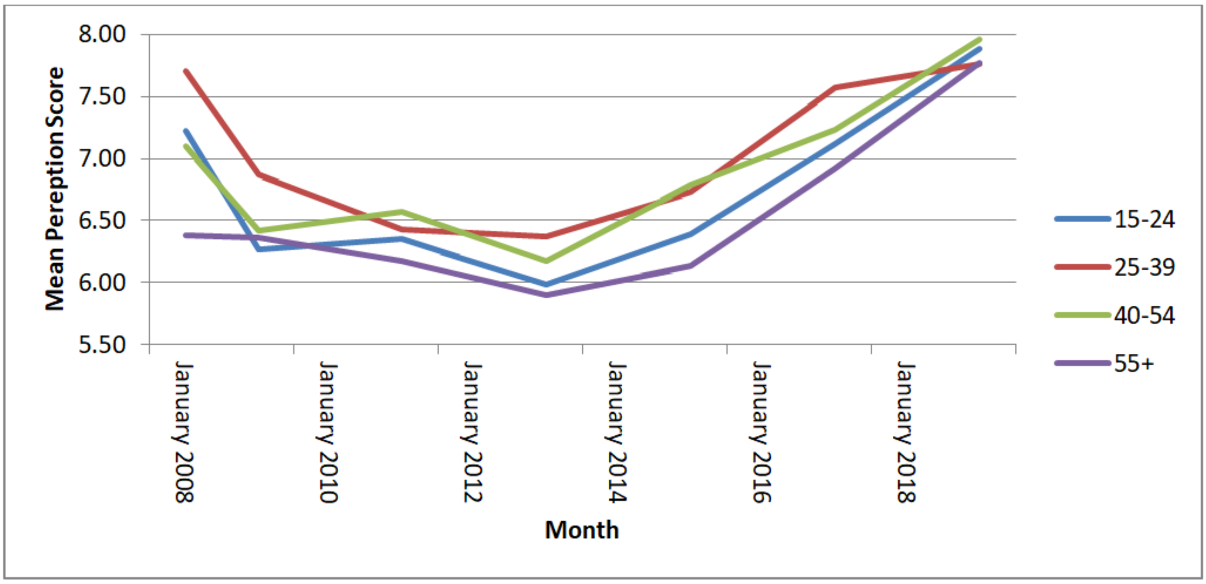


Figure 5.12 – Mean Perception Score for British Respondents to the question "How Serious a Problem is Climate Change?" based upon Age Groups

Source: Data Adapted from Eurobarometer (2008); Eurobarometer (2009); Eurobarometer (2011); Eurobarometer (2013); Eurobarometer (2015); Eurobarometer (2017); Eurobarometer (2019)

When the youth of the United Kingdom are compared to other European Union countries, it can be observed within Table 5.17 that they are ranked quite low down in 22nd and 17th place in June 2017 and April 2019, respectively. The gap below Malta, the top ranked country at both dates, is slowly closing from 1.21 to 0.94 in the intervening two-year period. This means that the difference between the younger respondents and the overall responses are becoming quite similar in comparison to other countries.

Table 5.17 – Top five countries within the European Union and the United Kingdom for 2017 and 2019 in ranked perception of how serious a problem climate change is currently viewed for respondents aged 15 to 24 years old

2017		
	Country	**Mean**
1	Malta	**8.37**
2	Greece	**8.29**
3	Italy	**8.26**
4	Spain	**8.23**
5	Sweden	**8.16**
22	United Kingdom	**7.16**
-	European Union	**7.51**

2019		
	Country	**Mean**
1	Malta	**8.82**
2	Italy	**8.71**
3	Spain	**8.62**
4	Hungary	**8.52**
5	Denmark	**8.49**
17	United Kingdom	**7.88**
-	European Union	**7.90**

Source: Data Adapted from Eurobarometer (2017) and Eurobarometer (2019). Full Figures are demonstrated in Appendix D.

Lastly, the Eurobarometer data allows us to compare socio group differences in the responses. Within the latest data, females within the United Kingdom were more likely to think that climate change was a serious problem compared to their male counterparts [7.95 versus 7.73]. This is consistent with Section 3.2.1.2 that highlighted that females are generally more concerned with environmental issues, such as climate change, albeit some of the data in the thesis shows this to be a barely significant difference. In terms of political identification, it was found that the further left the voter, the higher they score in terms of acknowledging the seriousness of climate change, with the average for a left-wing voter scoring 8.21 compared 7.09 for a right-wing voter. These results are consistent with past research (Whitmarsh, 2011; Unsworth and Fielding, 2014; Milfont *et al.*, 2015; Poortinga *et al.*, 2019; Ballew *et al.*, 2020), which suggest that there is some kind of political polarisation in climate change perception within the United Kingdom.

5.6. The Role of Terminology in Climate Change Perception

As highlighted in chapter three, the terms “climate change” and “global warming” have often been interchanged, especially by the media. In recent years, the media have moved more towards the term “climate change”. This is important as past research has shown that within the United Kingdom the images conveyed by each of the two terms are different amongst the public. Whitmarsh (2009) highlights that the term “climate change” is often associated with numerous impacts on the climate, impacts that have already occurred, and are of natural origins. Meanwhile, the research highlights the term “global warming” as often alluding to warm temperature impacts (e.g., melting of ice and increases in temperatures), is of anthropogenic origins associated with greenhouse gas emissions and has been mistakenly mis-associated with ozone depletion alone. The issue of using the 'global warming' term is that when an area experiences colder weather than normal it can almost feel contradictory. This can lead sceptics to air their negative opinions about the issue. An example of this has been observed in the United States in the past when, for example, Donald Trump in 2011 tweeted "It snowed over 4 inches this past weekend in New York City. It is still October. So much for Global Warming." (Trump, 2011, Online).

5.6.1. Personal Use of Terminologies

Different climate terminology can evoke certain images, such as for example, 'global warming' usually evokes an image of warm temperatures, whereas climate change can produce an image of more extreme meteorological events, such as storms. Consequently, differing people are using one term over the other, producing a varied national narrative that influences the perception of climate change. Respondents to the first thesis questionnaire [in 2017] were asked what term they use to describe the "current perceived change in the climate?"

As demonstrated in Table 5.18, the most popular choice was "climate change" at 60.67 per cent; with global warming second at 38.36 per cent of the responses. This demonstrates that there is a split in the public discourse about what to call "climate change". It is also demonstrated that eight respondents or 0.71 per cent, stated that the current perceived change in the climate is due to global cooling; the reason why some are still using this terminology is explored in Section 5.3.3.

Table 5.18 – Overall response in the first questionnaire to the term respondents use to describe the current change in the climate

Response	Number of Responses	Percentage
Climate Change	**688**	60.7%
Global Cooling	**8**	0.7%
Global Warming	**435**	38.4%
Refused	**3**	0.3%
Total	**1,134**	**100.0%**

Source: Author

As with the previous sections, it is likely that there are differences depending on respondent's socio-economic circumstances. Therefore, the rest of this sub-section will explore these factors further to further exposing factors pertinent to understanding a myriad of influences in the perception, engagement and overall response nexus.

The results in Table 5.19 demonstrate an increase in the number of respondents that use the term 'climate change', which is highest within the '35-44' age group, at 68.7 per cent. After this peak, the overall proportion that uses the term climate change is lower, with the age group '65+' having a similar response to the '18-24' age groups. Young people are significantly less likely to use the term 'climate change' compared to the '35-44' age group (χ2=3.873, p=0.049**).

Table 5.19 – Response in the first questionnaire to the term respondents use to describe the current change in the climate based upon the age groups

Response	18-24	25-34	35-44	45-54	55-64	65+	Sig.
Climate Change	93 57.1%	91 60.3%	79 68.7%	106 63.1%	142 61.7%	173 57.3%	**0.531**
Global Cooling	0 0.0%	1 0.7%	1 0.9%	2 1.2%	1 0.43%	3 1.0%	
Global Warming	70 42.9%	59 39.1%	34 29.6%	60 35.7%	86 37.4%	125 41.4%	
Refused / Don't Know	0 0.0%	0 0.0%	1 0.9%	0 0.0%	1 0.4%	1 0.3%	
Total	**163**	**151**	**115**	**168**	**230**	**302**	

Sig. = Significance; *N* = 1,129

Source: Author

It can be observed within Table 5.20 that males are more likely to use the term 'climate change' compared to their female counterparts by five per cent. This suggests that males are statistically more likely to use the 'climate change' term within normal conversation compared to females (χ2=2.788, p=0.095*). This is despite using a statistical difference test to compare all groups; it was found that there was no significant difference as demonstrated in Table 5.18. The proportion of responses indicating the term 'Global Cooling' is similar, both being just 0.7 per cent.

Table 5.20 – Response in the first questionnaire to the term respondents use to describe the current change in the climate based on gender

Response	Female	Male	Sig.
Climate Change	259 57.8%	425 62.8%	**0.229**
Global Cooling	3 0.7%	5 0.7%	
Global Warming	185 41.3%	245 36.2%	
Refused / Don't Know	1 0.2%	2 0.3%	
Total	**448**	**677**	

Sig. = Significance; *N* = 1,125. Source: Author

5.6.2. Google Searches

An effective way to tracking what people are calling a change in climate is by looking at the history of Google searchers by using an online package called 'Google Trends'. Figure 5.13 demonstrates the popularity score of 'climate change', 'global warming', 'global cooling', and 'climate emergency' between January 2004 and July 2020 within the United Kingdom. The inclusion of 'climate emergency' is due to the increased discussion of this term in 2019 by prominent news agencies. The values within Figure 5.13 are between 0 and 100. A value of 100 demonstrates that the term was the highest searched of all the terms; a value of 50 means it was roughly half as searched as the 100 value. A value of 0 means that the term was searched so few times within the United Kingdom, that Google Trends could not register a response.

The general observation throughout the sixteen and half year period demonstrated in Figure 5.13 is that in the early years the term 'global warming' was for most months the most searched term about the change in the climate. The term 'climate change' was searched more frequently than 'global warming' only five times in the first five years between 2004 and 2008, with all of these been observed in the month of August. The change of the popular used terms starts to be observed in 2009 onwards, when the search terms were similarly searched until 2014. At this stage, it becomes clearer that the term 'climate change' was searched more regularly than 'global warming'.

Overall, the British public searching using these terms followed a general decline throughout the late 2000s and the early to the mid-2010s for 'climate change' and global warming'. This coincides with what has been considered in this thesis as a period of declining concern with climate change amongst the civil society in United Kingdom [perception] and a decline in media coverage (Boykoff, 2011) and this will be explored within Section 5.9. However, in recent years there has been an increase of concern with climate change amongst civil society and this has coincided with an increase in the search of the topic on Google. This suggests that perception of climate change and engagement in searching for climate change related terms can be a two-way system. That whilst high levels of climate change can drive engagement of climate change, the relationship is paralleled by engagement of climate change to research the issue (such as reflected in online searches) drives up concern and perception of climate change.

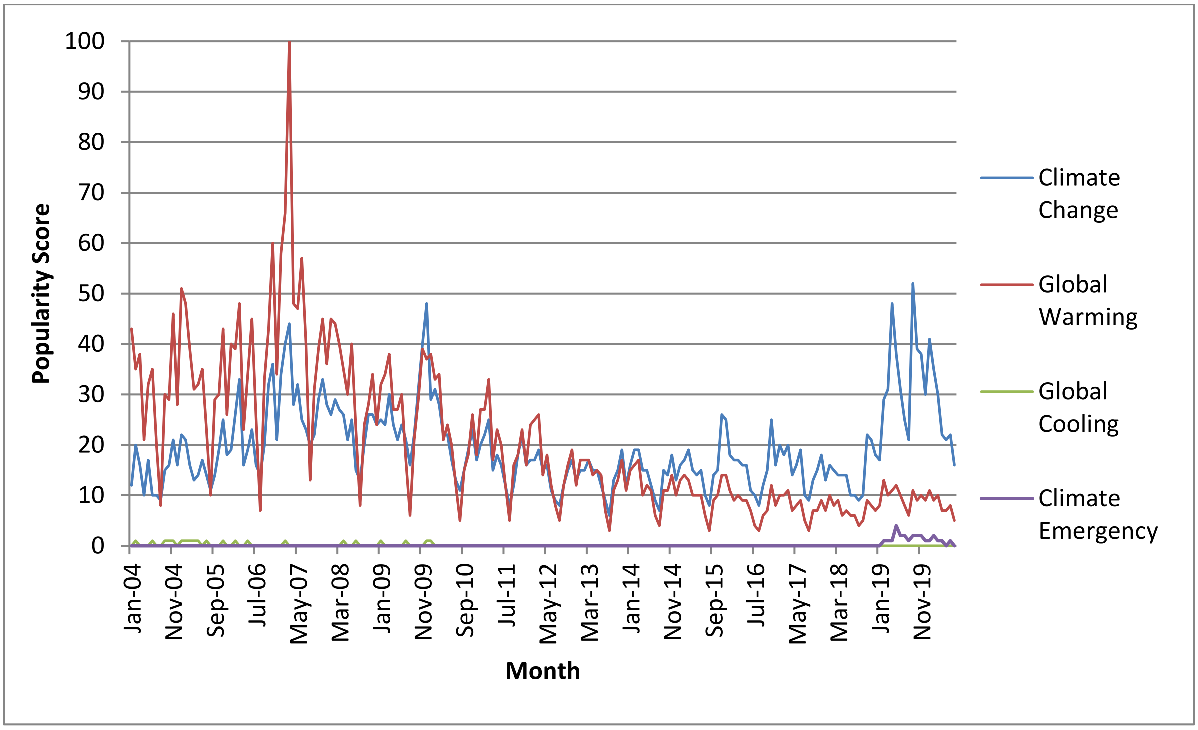


Figure 5.13 – Google Web Searches within the United Kingdom for Terms Climate Change, Global Warming, Global Cooling and Climate Emergency between January 2004 and July 2020

Source: Data Adapted from Google Trends (2020). Full values are available in Appendix AC.

In addition to the usage and consequent understanding of climate change throughout the time period, this aspect of the research allows analysis of when climate change was most talked about within the United Kingdom. This is demonstrated with the large spike for communications about 'global warming' in March 2007. The most likely explanation of this spike is the release of a polemical documentary film called "The Great Global Warming Swindle" by Channel 4. This film will be discussed more in Section 5.9 of this thesis. In addition, there was another spike in the previous month, due to the release of Al Gore's documentary film "An Inconvenient Truth" winning two awards at the Academy Awards.

To further demonstrate how events can result in engagement of the public to search for climate change related terms, there were two spikes for the term 'climate change' in November/December 2015 and November 2016. Both spikes are likely to be due to Agreement and Effective of the Climate Change Paris Agreement, respectively.

In addition, it can be observed that since late 2018, there has been a large increase in the amount of searching of the term 'climate change', and it is at its most sustained level since the late 2000s. This is likely to do with the increase of climate activism that has occurred both within the United Kingdom and throughout the world, due to the rise of 'Extinction Rebellion', the 'School Strikes for Climate' and the activist Greta Thunberg. These groups and individual will be discussed in much greater detail in Chapter Seven.

The term 'global cooling' was rarely searched throughout the period, with only a few times in sporadic intervals that this term receives popularity score of 1. The most recent score of 1 was during the winter of 2009-10, which happened to coincide with the unusually snowy and cold winter that occurred across the whole of the United Kingdom. This is perhaps is a demonstration that extreme meteorological events, as well as activism and political events, can influence the number of times the public search for climate related terms.

Lastly, the term 'climate emergency', before 2019 was ranked with a popularity score of 0, indicating that virtually nobody was searching for this term on Google. However, there has since been an increase in its usage, but despite being named as the Oxford Dictionary Word of the Year for 2019 (Zhou, 2019), it only scored 4 at its peak in May 2019. This timing of this peak coincided with its informal declaration by the UK Parliament. In addition, as with all the other terms, the search frequency of the term 'climate emergency' reduced back to a score of 1, returning nearly back to pre-2019 levels. Arguably, this demonstrates that despite all the hype that was building around this term by activists and the media, the public are still using the terms that had been set out by scientists and academics.

5.6.3. Personal Perception of Change Associated with Each Term

Whilst the public are confirmed here to have different imagery, and consequent perceptions, associated with the terms 'climate change' and 'global warming', as had been approached by Whitmarsh (2009), previous research had not extended to what the public think is the cause of each phenomena. Therefore, the respondents were asked within the first questionnaire "what do you think is the cause of both climate change and global warming?". The respondents were given the same three choices within Section 5.6.1 ['Natural Processes', 'Human Processes', and 'Both Human and Natural Processes']. This question can determine whether the respondents really do see the two main terms differently in terms of their causes. It should be noted, that for this section the term 'global cooling' was not used. It does not have widespread usage within the academic literature as research has shown the planet is warming.

Table 5.21 demonstrates that for both terms, the majority believe the underlining causes are both 'natural and human processes', albeit with differences in the proportions of responses. For example, with the term climate change, respondents were significantly more likely to believe that it is due a mixture of both natural and human processes [59.6 per cent] compared the term global warming [50.7 per cent] ($\chi2=4.467$, $p=0.035$**). There was a significant difference between the two terms for every different potential climate related process. The data suggests that, where respondents consider natural processes or combined natural and human processes, they are significantly more likely to refer to climate change, and where they consider human processes alone in this context, they are significantly more likely to refer to global warming (10.5 per cent difference).

Table 5.21 – Respondents belief in the causation of 'Climate Change' and 'Global Warming' in 2017

<table>
<tr><th></th><th><u>Climate Change</u></th><th><u>Global Warming</u></th><th colspan="2"><u>Significance</u></th></tr>
<tr><td>Natural Processes</td><td>102
9.0%</td><td>75
6.6%</td><td>0.035**</td><td rowspan="4">0.000***</td></tr>
<tr><td>Human Processes</td><td>348
30.7%</td><td>467
41.2%</td><td>0.000***</td></tr>
<tr><td>Both Natural and Human Processes</td><td>676
59.6%</td><td>575
50.7%</td><td>0.000***</td></tr>
<tr><td>Don't Know</td><td>8
0.7%</td><td>17
1.5%</td><td>0.703*</td></tr>
<tr><td>Total</td><td>1,134</td><td>1,134</td><td></td><td></td></tr>
</table>

*** = Significant at the 90 per cent significance; ** = Significant at the 95 per cent significance; *** = Significant at the 99 per cent significance. Note – Not all columns add up exactly to 100 per cent due to rounding error.**

Source: Author

Regarding the thoughts and beliefs of the youngest age group, there are some significant differences compared to the other age groups as demonstrated within Table 5.22. The proportion of respondents that believe the term climate change is associated with human processes reduces from 31.4 per cent for the age groups above 24 years old to 26.4 per cent for the age group 18 to 24 years old.

The younger generation are significantly less likely to believe that global warming is due to natural processes [4.1 per cent difference], whilst at the same time, they are significantly more likely to believe it is due to human processes [8.5 per cent difference]. It should also be noted that the younger generation is more likely to use the term 'global warming' proportionally compared to other age groups, as demonstrated within Table 5.17. This suggests the younger generation have a higher belief that human processes are causing the current change in the climate [albeit just 43.7 per cent for 18–24 year-olds compared to the 41.4 per cent for 25+]. Also, as demonstrated within Table 5.3, it is suggesting that younger people consider (through image perception of the terminology) that global warming is more exclusively due to human processes.

Table 5.22 – Respondents [aged 18-24] belief in causation behind the terms 'Climate Change' and 'Global Warming' in 2017, and as compared with other age groups

	Climate Change		Global Warming		Significance	
	Result	Diff.	Result	Diff.		
Natural Processes	15 9.2%	+0.2%	5 3.1%	-4.1%**	**0.021****	**0.000*****
Human Processes	43 26.4%	-5.0%	79 48.5%	+8.5%**	**0.000*****	
Both Natural and Human Processes	105 64.4%	+5.6%	79 48.5%	-2.5%	**0.004*****	
Don't Know	0 0.0%	-0.8%	0 0.0%	+1.8%		
Total	**163**		**163**			

**** = Significant at the 95 per cent significance; *** = Significant at the 99 per cent significance. Note – Not all columns add up exactly to 100 per cent due to rounding error.**

Source: Author

5.6.4. Fearfulness

O'Neill and Nicholson-Cole (2009) highlight that climate change fear has been used extensively in the past within the United Kingdom to promote climate change to the public. Examples of this have been within the Green Party's election manifesto, which included the term "climate **emergency**" (Green Party, 2019); or the name of a protest group ["**Extinction** Rebellion"].

Research in the past has shown that the media like to use the fear factor as it increases newsworthiness of the issue as they link to the threats to humanity (Weingart, Engels and Pansegray, 2000). However, recent research has demonstrated that this approach might be contributing to negative engagement due to eco-anxiety (Nugent, 2019; Sharman and Nunn, 2019).

Accordingly, the respondents within the first questionnaire were asked "how fearful are you of both climate change and global warming?". The responses were registered using a Likert Scale, with a score of '1' meaning that they were not fearful at all; and '5' meaning that there were very fearful. This was to see what level of fearfulness is associated with the two concepts.

Table 5.23 demonstrates that overall, the respondents are slightly more fearful about global warming [3.75] compared to climate change [3.73] but not significantly so. However, the high means suggest that the public are quite fearful of both phenomena, which, as highlighted earlier could mean they are at increased risk of eco-anxiety. As this survey was undertaken in 2017, and before the peak in climate change interest due the climate activism in 2019, there will need to be further research in the future to see if this level of fearfulness amongst the British public is increasing.

Table 5.23 – Fearful scoring for 'Climate Change' and 'Global Warming' based upon differing socio-economic groups

	Climate Change				Global Warming				Sig.
	Mean	S.D.	Skew.	Kurt.	Mean	S.D.	Skew.	Kurt.	
Overall	3.73	1.088	-1.026	0.607	3.75	1.112	-1.040	0.553	0.456
Age									
18-24	3.88	0.935	-1.009	1.074	3.86	1.012	-1.069	0.883	0.771
25-34	3.79	0.933	-1.124	1.592	3.87	0.869	-1.117	1.949	0.132
35-44	3.78	1.082	-1.328	1.505	3.80	1.102	-1.355	1.556	0.639
45-54	3.68	1.110	-0.936	0.353	3.69	1.089	-0.885	0.311	0.649
55-64	3.71	1.132	-1.011	0.405	3.72	1.155	-1.023	0.352	0.548
65+	3.63	1.185	-0.874	0.041	3.64	1.244	-0.878	-0.124	0.687
Gender									
Male	3.67	1.121	-0.969	0.363	3.67	1.164	-0.954	0.194	0.894
Female	3.81	1.037	-1.105	1.012	3.86	1.026	-1.147	1.175	0.245
Ethnicity									
White	3.73	1.092	-0.992	0.520	3.74	1.116	-1.015	0.482	0.593
Ethnic Minority	3.71	1.089	-1.208	1.042	3.73	1.114	-1.146	0.844	0.711
Household Income									
<£10,000	3.56	1.125	-0.992	0.363	3.69	1.117	-1.092	0.645	0.159
£10,000 - £19,999	3.80	1.060	-1.041	0.798	3.76	1.131	-0.931	0.236	0.298
£20,000 - £29,999	3.71	1.142	-1.120	0.624	3.75	1.124	-1.086	0.612	0.530
£30,000 - £39,999	3.72	1.106	-0.967	0.415	3.72	1.136	-1.022	0.507	0.814
£40,000 - £49,999	3.69	1.003	-1.010	1.098	3.72	1.029	-1.091	1.181	0.241
>£49,999	3.77	1.082	-1.033	0.660	3.77	1.112	-1.057	0.586	1.000

S.D. = Standard Deviation; Skew. = Skewness; Kurt. = Kurtosis; Sig. = Significance.

Source: Author

In addition to this, it was found that there were no significant differences between the two terms within the different socio-economic factors that were researched. Therefore, it is suggested here that most of the public view the two terms just as important as each other and are fearful of the impacts of either.

The issue of fearfulness and its potential role in perception of climate change, as detected from this research and the results presented in Table 5.23, is summarised as follows:

- The most fearful of 'climate change' are those who are aged between 18 and 24 years; female; of white ethnicity; and who have a household income of between £10,000 and £19,999.
- The most fearful of 'global warming' are those who are aged between 25 and 34 years; female; of white ethnicity; and have a household income of over £49,999.

5.6.5. Ongoing Discussion on Terminology

As highlighted previously, both 'global warming' and 'climate change' have their own technical definitions and have been interchanged in the media. However, it has become apparent that the interchange of these two terms can lead to confusion and scepticism. As some individuals believe that when the weather is cold, the educational sector calls it 'climate change' and use 'global warming' for when extreme heat and rainfall events occur.

However, as highlighted in the previous few sub-sections, there is a further term, "Global Cooling". The term was extensively used in the 1970s, especially in the United States media, to explain the change in the climate. Whilst most of the scientific community were already publishing research about "global warming", there were media reports through several major publications, such as the New York Times and the Washington Post, which give accentuation to some research about 'global cooling' as a topic of the time, some of which is reflected in Table 5.10. This has resulted in influencing some people to be climate sceptics. For example, respondent CCAA1432 highlights that "scientists have been predicting that an Ice Age is coming and I was taught this sixty years ago at school … nothing has changed" [Male, 65+, East Midlands] and respondent CCAB0046 who say that they remember being "told that we were all facing a new ice age – early 60's" [Male, 65+, East of England]. From the qualitative elements of this research, these types of arguments demonstrate scepticism about climate change and are more common reactions from the more elderly respondents.

However, this argument and the earlier discussion regarding the interchange of the terms 'climate change' and 'global warming' are indicative issue of perception for the academic community to take on board going forward, since it can be argued that perception and reality are crucial influences on understanding varying forms of engagement. Should, for example climate change mitigation and adaptation strategies focus on communication of the issue of climate change using just one defining term, instead of several? It is already apparent that the interchanging of the terms has been and remains a breeding ground for climate scepticism.

5.7. Uncertainty

As discussed within preceding chapters of this thesis, climate change poses serious long-term global environmental damage and threats toward nature and humanity. The issue was discovered by the scientific community, which in turn defined the issue using scientific measurements, which is communicated through the media towards the public. However, since climate change is a slow onset disaster trajectory that is difficult or near impossible to be directly 'seen' or experienced over shorter time frames (rapid onset events are seen as exceptional), the scientific community become reliant on the media [both traditional and social] to communicate these risks to the public. This process then becomes significant in driving an individual's perception towards climate change, as to whether it is a serious and authentic threat. The previous sections of this chapter highlighted that the majority currently believe in anthropogenic climate change and that this threat is great, but there is heterogeneity in responses. This is similar to what has been described in the first three chapters of thesis, which recognised that there is still some disagreement on the causes and the threats of climate change within the scientific community and elected officials, in relation to which some respondents draw arguments consistent with the sceptics.

In theory, it can be expected that visual evidence and overall opinion of those considered to be climate experts can stipulate to the public that anthropogenically induced climate change is verity. This is reinforced due to individual meteorological events that are now more clearly tending to be associated with climate change. This has already been demonstrated by Bibbings (2004, p.2) within Wales who highlighted that 85 per cent of the respondents believed that changes in weather patterns could be "proof of changing climate".

On the contrary, some people acknowledge that there are differences between the forms of evidence provided. This is demonstrated by respondent CCAB0021, who states that "more research required. Climate and weather are different, and I think that this difference is forgotten" [Male, 55-64, East of England]. Respondent [OLA048] stated something similar, when asked within the first questionnaire if being affected by an extreme meteorological condition changed their perception of climate change; they stated that "Single weather events cannot be representative of climate change, long-term regional and global trends are" [Male, 35-44, Unknown]. This is a point backed up by the scientific community who have in the past been very careful to try to communicate this. However, the imagery of the event that is fresh in the mind means psychologically that a respondent thinks it has just happened, and then by deduction that it could happen again.

As Lewis and Gallant (2013, Online) stated "in science, the only certainty is uncertainty". Despite all the research that has been conducted in the last thirty plus years about climate change, as highlighted within the latest IPCC report, there is a small degree of uncertainty. But, as highlighted in numerous studies there is overwhelming belief in anthropogenic climate change amongst the scientific community (Cook *et al.*, 2013). Most of the uncertainty within the science of climate change is with regards to exact impacts on both humanity and the natural ecosystem at both the regional and local levels (Dessai and Hulme, 2007; Field *et al.,* 2014). Despite all this supportive evidence that the educational sector has given in recent years, as demonstrated in earlier chapters, there are some media outlets that report on this uncertainty as disagreements about the cause and severity of the current climate change amongst the scientific community, and this is used within the political world. This uncertainty has influenced the public perception of climate change. Chapter three demonstrated that these uncertainties by scientists and politicians get amplified through the media, which has created controversy about the issue. This has led some people amongst wider society to be confused about what to believe about climate change leading to respondents, such as CCAA0478, stating that there is "a lot of differing information and hard to know what to believe and it's very frustrating" [Male, 18-24, North East England]. This respondent is not alone, within the BEIS questionnaires in March 2020, it was found that 26.4 per cent overall agree strongly with the statement that "there is so much conflicting information about climate change, it is difficult to know what to believe"; this is an increase of 1.6 per cent from March 2019. These results are demonstrated in more detail in Figure 5.14. It shows that this increase in responses that agree strongly to the fourth statement provided were not significant ($\chi 2=1.708$, $p=0.191$). However, the science education sector is overall trying to send a clear and simple message about climate change, as it is seemingly being challenged by non-experts, such as those listed in Chapter One and by some sections of the media. The residual uncertainty is likely to continue to confuse the public as to what they personally should be undertaking next to help mitigate against the threat that climate change is projected to have on the United Kingdom.

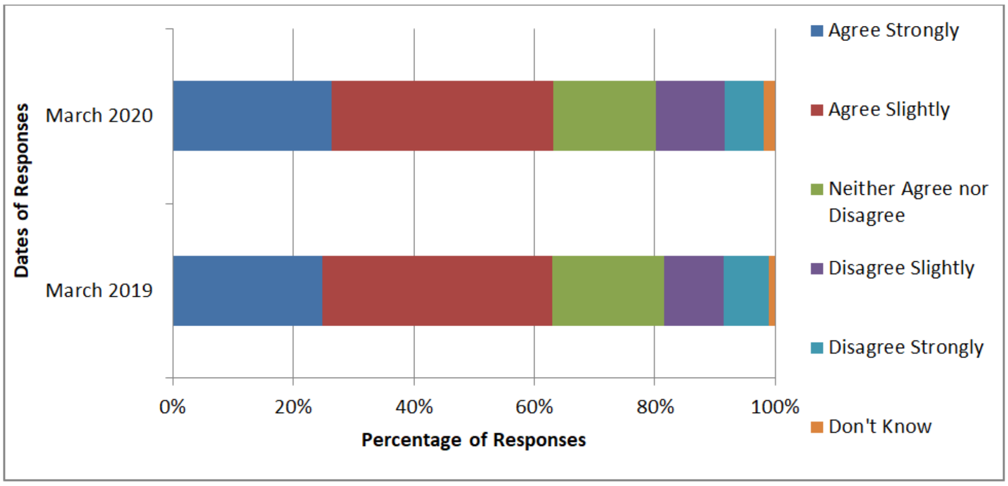


Figure 5.14 – Overall Perception About Whether There Is Too Much Conflicting Information on Climate Change in Both March 2019 and March 2020

Source: Data Adapted from BEIS (2019b) and BEIS (2020b)

The results from BEIS (2019a) dataset were also used in Table 5.24 by merging the agree options and disagree options. The mean values, using five different options were converted into a Likert Scale for this exercise; with 1 meaning that they strongly agree and 5 meaning that they strongly disagree. It should also be noted that those who had a response of ‘Don’t Know’ were not included in the mean score.

Table 5.24 – Perception about whether there is too much conflicting information on climate change in March 2019

	Agree	Neither Agree nor Disagree	Disagree	Don’t Know	Mean	Significant
Overall	2658 62.9%	786 18.6%	731 17.3%	49 1.2%	2.36	
Age						
16-24	253 53.3%	107 22.5%	110 23.2%	5 1.1%	2.64	**0.000****
25-34	388 59.8%	130 20.0%	123 19.0%	8 1.2%	2.46	
35-44	337 58.6%	122 21.2%	111 19.3%	5 0.9%	2.45	
45-54	325 61.7%	82 15.6%	112 21.3%	8 1.5%	2.46	
55-64	413 67.6%	85 13.9%	110 18.0%	3 0.5%	2.29	
65+	942 67.9%	260 18.7%	165 11.9%	20 1.4%	2.18	
Gender						
Male	1278 62.7%	376 18.4%	364 17.9%	20 1.0%	2.38	**0.600**
Female	1380 63.1%	410 18.8%	367 16.8%	29 1.3%	2.35	
Ethnicity						
White	2385 64.0%	650 17.4%	659 17.7%	34 0.9%	2.35	**0.000*****
Ethnic Minority	255 55.8%	126 27.6%	65 14.2%	11 2.4%	2.45	
Area						
Urban	2036 62.0%	639 19.4%	572 17.4%	39 1.2%	2.38	**0.047****
Rural	622 66.3%	147 15.7%	159 17.0%	10 1.1%	2.30	

Table 5.24 – Perception about whether there is too much conflicting information on climate change in March 2019 (Continued)

	Agree	Neither Agree nor Disagree	Disagree	Don't Know	Mean	Significant
			Social Grade			
AB	445 58.5%	92 12.1%	222 29.2%	2 0.3%	2.61	**0.000*** **
C1	680 62.4%	163 15.0%	237 21.8%	9 0.8%	2.45	
C2	563 65.8%	169 19.7%	118 13.8%	6 0.7%	2.26	
DE	970 63.9%	362 23.8%	154 10.1%	32 2.1%	2.23	
			Household Income			
<£16,000	583 64.6%	181 20.1%	129 14.3%	9 1.0%	2.29	**0.000*** **
£16,000 - £24,999	350 65.9%	92 17.3%	87 16.4%	2 0.4%	2.30	
£25,000 - £34,999	268 65.4%	59 14.4%	81 19.8%	2 0.5%	2.35	
£35,000 - £49,999	228 63.3%	52 14.4%	79 21.9%	1 0.3%	2.47	
>£49,999	178 51.7%	35 10.2%	131 38.1%	0 0.0%	2.87	

*** = Significant at the 90 per cent significance; ** = Significant at the 95 per cent significance; *** = Significant at the 99 per cent significance. Note – Not all columns add up exactly to 100 per cent due to rounding error.**

Source: Data Adapted from BEIS (2019b)

Table 5.22 demonstrates that, except for the age group 35-44, the higher the age group, the more respondents believe that there is too much conflicting information about climate change.

Those who are above 65, of white ethnicity, live in a rural area, are of social grade DE, and have a household income less than £16,000 are the most likely to believe there is too much conflicting information on climate change. Again, as highlighted earlier in the chapter, the over 65 age group, of social grade DE and living near the breadline are the most vulnerable to extreme meteorological events that climate change is expected to make frequent. This is concerning here as conflicting information leads to confusion about the level of threat. As highlighted within Table 5.11, similar groups are also amongst the lowest representing their views about the severity of the threat that climate change is having on the United Kingdom. Whilst no information about education was recorded within the BEIS datasets, those who are more elderly and are of social grade DE are typically individuals with lower levels of education.

The previous quote and these results are likely to be in part a product of manufactured uncertainty. Manufactured uncertainty is a tactic that has been used by industries to either delay or prevent regulations on environmental protection (Michaels and Monforton, 2005), such as climate change. This is a strategy that was first deployed by the tobacco industry and is now being used for other regulations to promote the fact that science has some uncertainty or is flawed (Michaels and Monforton, 2005). However, a potential further effect is that this inserts doubt amongst society about how the science behind climate change is being vindicated. An example of the contradictions that both fuel but also expose the uncertainly is demonstrated by ExxonMobil, who have been known to be aware of climate change and its severity as early as 1977, but who created Global Climate Coalition which have questioned the well-established science of climate change (Hall, 2015).

5.8. Scientific Consensus

As highlighted, uncertainty, especially manufactured uncertainty, can have an impact on trust and the public perception surrounding the scientific consensus on 'controversial' issues pertinent to civil society, such as climate change. This does not account for the scientific consensus on climate change. Scientific consensus about issues such as climate change is fundamental to being able to create a perception of such issues (Lewandowsky, Gignac and Vaughan, 2013), which in turn will give foundations for the civil society and politicians to start taking actions in either mitigating and/or adapting to the issue; this process is termed by some as the 'The Gateway Belief Model' (van der Linden *et al.,* 2015). Recent research has shown that even a small dissent amongst the scientific community about scientific issues can enfeeble the support of civil society within the issue of concern. Past research has demonstrated that there are 97 per cent of climate scientists that agree anthropogenic activity is the main cause of the current change in the climate (Cook *et al.*, 2013), but there a variation in this percentage depending on the study and this produces the risk of inaction.

Despite this high level of scientific consensus, and reporting of climate change within the media, debate about the cause of current climate change persists (examples are given in Table 3.3 and 5.8). To gain in indication of proportions of the public that believe there is a scientific consensus on climate change respondents in the first questionnaire were asked "what do you think is the percentage of climate scientists that believe humans are causing climate change/global warming?". The respondents were given five different options with 20 per cent intervals between the options. Figure 5.15 demonstrates the breakdown of what the respondents felt climate scientists believed about anthropogenic climate change.

It was found that the most chosen response, was ‘80-100%’ (46.8 per cent). In addition, it was found that most of the respondents believed that there was majority consensus that climate change was occurring (74.5 per cent). A similar study was conducted by Leiserowitz *et al.* (2019a) within the United States, which found that only 33 percent went for 80-100 per cent. A part of the reason for this difference is due to the high level of respondents within the United States’ study which chose the ‘Don’t Know’ option, with 22 per cent choosing this option, compared to 1.5 per cent within this study. This suggests that there was a significant difference between the two countries in the belief in a scientific consensus. However, the Leiserowitz *et al.* (2019a, p.9) study highlights that there has been an increasing level of respondents, showing that Americans believe that “most scientists think global warming is happening”. In the future, researchers of this type of scientific consensus data will need to monitor this information within the United Kingdom in a similar approach undertaken by the United States in recent years. It is important to note that the scientific consensus plays a fundamental role in the formation of climate change perception amongst civil society.

A similar question was asked in a study by Steentjes *et al.* (2017), which it found that 30 per cent of respondents within the United Kingdom said the scientific consensus of climate change is above 80 per cent. This represents a 16.1 per cent difference between the two results, which were taken roughly a year apart. This could be because of three possible reasons. The first reason may be due to the lack of ‘don’t know’ answers within this study compared to Steentjes *et al.* (2017), which was 11 percent compared to the 1.5 within the first questionnaire of this thesis. The second potential reason for the difference is due to a difference in the sampling method between the two studies. The final potential reason could be a real increase in the proportion of the public who thinks there is an ‘80+’ per cent consensus about climate change amongst the scientific community. This is possible, as Figure 5.15 showed that the overall view on the seriousness of climate change has been increasing since 2013 within the United Kingdom across all age groups.

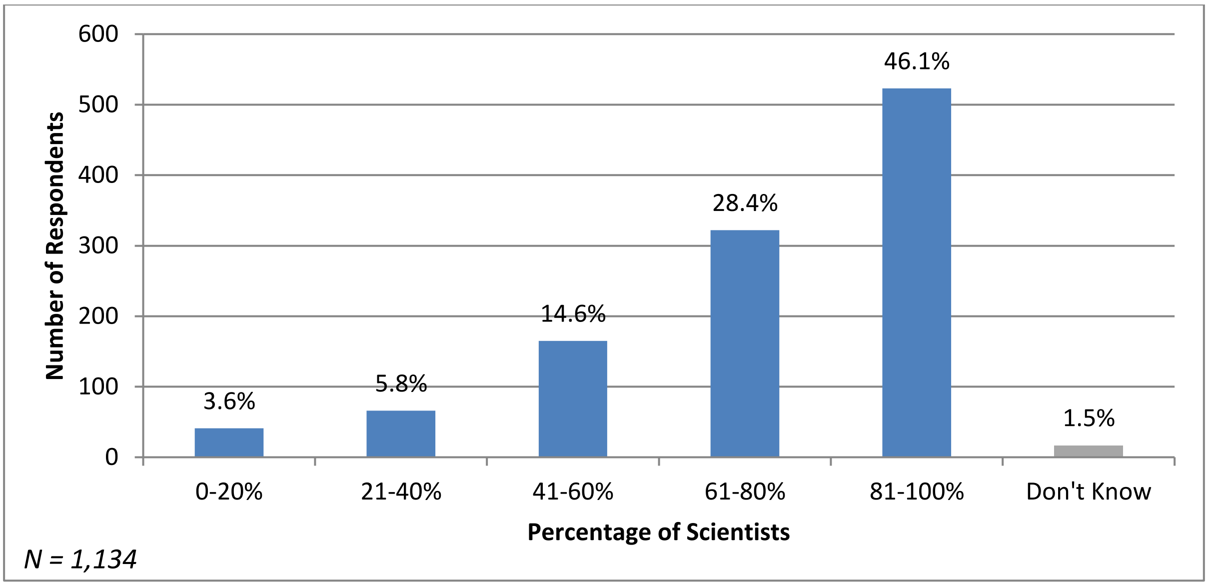


Figure 5.15 – Perception in the UK of Scientific Consensus on Climate Change in 2017

Source: Author

This sub-section has exposed the differences in overall perception of scientific consensus amongst respondents and in comparison, to other studies. The following sub-sections will investigate this difference with respect to different socio-demographic groups.

5.8.1. Socio-Economic Differences

In terms of youth, it is found that 42.9 per cent of the respondents between the age of 18 and 24 chose the 81-100 per cent consensus choice, below the level for other age groups. However, there is a trend beyond this age group, which suggests as the age groups increase, the overall belief of a '81-100' per cent consensus declines, from 60.9 per cent for the '25-34' age group to 40.7 per cent within the '65+' age group. The difference between the two youngest age group's responses for the '81-100%' option is 18 per cent and can be concluded as significant ($\chi 2=10.149$, $p=0.001$***).

For the gender differences, demonstrated within Table 5.25, there was a significant difference at the 99 per cent significance; with females less likely to believe in an overwhelming scientific consensus about climate change. Lastly, for the top option of 81 to 100 per cent scientific consensus, the perception rate falls when the household income increases, until after the £30,000 threshold when it starts to increase.

Table 5.25 – Perception in the United Kingdom of Scientific Consensus on Climate Change in 2017 Based upon Different Socio-Economic Groups

	0-20%	21-40%	41-60%	61-80%	81-100%	Don't Know	Sig.
Overall	41 3.6%	66 5.8%	165 14.6%	322 28.4%	523 46.1%	17 1.5%	
				Age			
18-24	3 1.8%	7 4.3%	28 17.2%	54 33.1%	70 42.9%	1 0.6%	**0.028****
25-34	3 2.0%	5 3.3%	20 13.2%	31 20.5%	92 60.9%	0 0.0%	
35-44	1 1.7%	5 4.3%	18 15.7%	28 24.3%	61 53.0%	1 0.9%	
45-54	6 3.6%	10 6.0%	22 13.1%	48 28.6%	80 47.6%	2 1.2%	
55-64	11 4.8%	19 8.3%	28 12.2%	74 32.2%	97 42.2%	1 0.4%	
65+	16 5.3%	20 6.6%	49 16.2%	87 28.8%	123 40.7%	7 2.3%	
				Gender			
Male	29 4.3%	30 4.4%	84 12.4%	177 26.1%	349 51.6%	8 1.2%	**0.001*****
Female	11 2.5%	36 8.0%	80 17.9%	145 32.4%	172 38.4%	4 0.9%	
				Household Income			
<£10,000	3 4.5%	3 4.5%	9 13.6%	18 27.3%	32 48.5%	1 1.5%	**0.006*****
£10,000 - £19,999	3 1.9%	10 6.3%	18 11.3%	57 35.6%	72 45.0%	0 0.0%	
£20,000 - £29,999	9 4.6%	13 6.6%	37 18.8%	55 27.9%	83 42.1%	0 0.0%	
£30,000 - £39,999	4 2.1%	16 8.2%	32 16.5%	54 27.8%	86 44.3%	2 1.0%	
£40,000 - £49,999	10 6.7%	4 2.7%	28 18.7%	35 23.3%	73 48.7%	0 0.0%	
>£49,999	8 2.6%	14 4.6%	25 8.3%	89 29.5%	160 53.0%	6 2.0%	

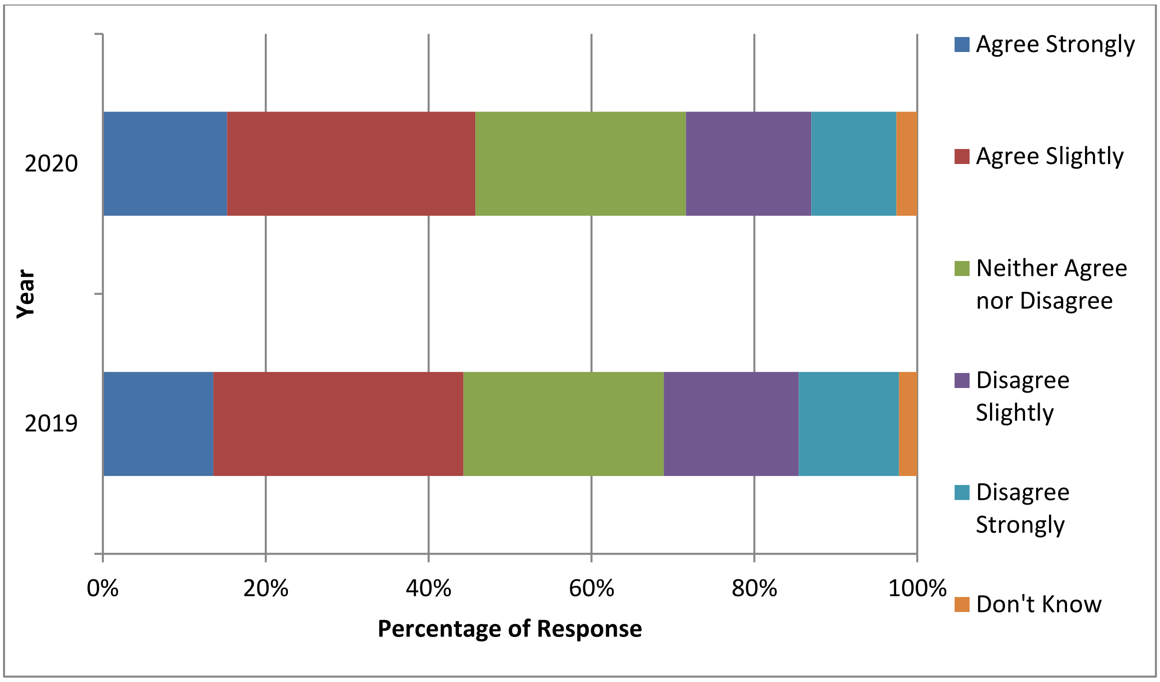
***N* = 1,134; Sig. = Significance; ** = 95 per cent significance; *** = 99 per cent significance; Note: All Percentages might not add up to 100 per cent due to rounding errors.**

Source: Author

5.9. Media

As reviewed throughout Section 3.5, the media is important in communicating the science of climate change, as it is the most frequent way to disseminate the message. However, it has also become a way to disseminate misinformation about climate change. This has increasingly been the case with the advent of social media, which has given many people, including the climate sceptics and deniers, a more equal and vocal platform to air their opinions. This raised the question as to whether the loudest media get heard the most. Arguably media can create an uncertainty amongst civil society within the United Kingdom and elsewhere, as demonstrated by public understanding of scientific consensus in Figure 5.13 and by data presented in Table 5.26. With the prospect of climate change bringing a ghastly world, 'doom and gloom' headlines may be considered by some as under or over-exaggerated. Another interpretation is that the impacts of climate change are presented in a way to catch the readers' attention, along the lines of what was shown in Table 3.3.

To better evaluate how respondents think the media is exaggerating climate change, in the BEIS questionnaires the respondents were asked whether they agree or disagree to whether they believe "the media exaggerates the impacts of climate change". This question used a Likert Scale between 1 and 5, with 1 meaning 'Agree Strongly' and 5 meaning 'Disagree Strongly'. The overall results from March 2019 and March 2020 are demonstrated in Figure 5.16. The data suggests that within both March 2019 and 2020, there was a 1.4 percent increase in respondents that believed the media were exaggerating the impacts of climate change. However, the dataset provided by the Department for BEIS does not indicate which media respondents had been influenced by or which sources appear to over or under exaggerate climate change the most.



2019 N = 4,224; 2020 N = 1,851

Figure 5.16 – Agreement that "the media exaggerates the impacts of climate change"

Source: Data Adapted from BEIS (2019b) and BEIS (2020b)

In this chapter, it has been determined that there are socio-economic differences in the perceptions of the respondents. Therefore, Table 5.24 presents data across the whole sample and is not limited to just the '16-24' age group, but with low number of respondents within this age group, there is a potential for a lack of strength in the results in this instance.

Nonetheless data in Table 5.26 confirms that the youngest age group are the least likely to believe that the media are exaggerating the impacts of climate change (2.05 average); whereas the oldest (65+) are the most likely to believe this (1.72 average). The average gap response difference between the two age groups is 0.33, and there is a significant difference between these two, at the 99 per cent significance ($t(821.6)=7.668$, $p=0.000$***). In addition, it can be observed that there is a significant difference between each of the socio-economic factors considered here, apart from the area in which they reside (urban vs rural).

In summary these results show that those who think that the media is exaggerating the impacts of climate change are those who are over the age of 65, male, of white ethnicity, living in a rural area and of social grade C2, having an income of less than £16,000 a year.

Table 5.26 – Proportion of Response to the Question "the media exaggerates the impacts of climate change" based upon differing social-economic factors

	Agree	Neither Agree nor Disagree	Disagree	Don't Know	Mean	Significant
Overall	1870 44.3%	1039 24.6%	1221 28.9%	94 2.2%	1.84	
			Age			
16-24	151 31.8%	141 29.7%	175 36.8%	8 1.7%	2.05	**0.000*** **
25-34	257 39.6%	167 25.7%	207 31.9%	18 2.8%	1.92	
35-44	240 41.7%	155 27.0%	169 29.4%	11 1.9%	1.87	
45-54	230 43.6%	125 23.7%	157 29.8%	15 2.8%	1.86	
55-64	277 45.3%	147 24.1%	179 29.3%	8 1.3%	1.84	
65+	715 51.6%	304 21.9%	334 24.1%	34 2.5%	1.72	
			Gender			
Male	974 47.8%	478 23.5%	550 27.0%	36 1.8%	1.79	**0.000*** **
Female	896 41.0%	561 25.7%	671 30.7%	58 2.7%	1.89	
			Ethnicity			
White	1672 44.8%	879 23.6%	1102 29.6%	75 2.0%	1.84	**0.000*** **
Ethnic Minority	184 40.3%	149 32.6%	109 23.9%	15 3.3%	1.83	
			Area			
Urban	1439 43.8%	823 25.0%	951 28.9%	73 2.2%	1.85	**0.576**
Rural	431 45.9%	216 23.0%	270 28.8%	21 2.2%	1.82	

Table 5.26 – Proportion of Response to the Question "the media exaggerates the impacts of climate change" based upon differing social-economic factors (Continued)

	Agree	**Neither Agree nor Disagree**	**Disagree**	**Don't Know**	**Mean**	**Significant**
Social Grade						
AB	321 42.2%	131 17.2%	299 39.3%	10 1.3%	1.97	**0.000*** **
C1	446 41.0%	255 23.4%	374 34.3%	14 1.3%	1.93	
C2	401 46.8%	228 26.6%	212 24.8%	15 1.8%	1.78	
DE	702 46.2%	425 28.0%	336 22.1%	55 3.6%	1.75	
Household Income						
<£16,000	405 44.9%	229 25.4%	246 27.3%	22 2.4%	1.82	**0.000*** **
£16,000 - £24,999	237 44.6%	131 24.7%	160 30.1%	3 0.6%	1.85	
£25,000 - £34,999	183 44.6%	78 19.0%	144 35.1%	5 1.2%	1.90	
£35,000 - £49,999	158 43.9%	87 24.2%	110 30.6%	5 1.4%	1.86	
>£49,999	113 32.8%	61 17.7%	168 48.8%	2 0.6%	2.16	

***** = Significant at the 99 percent significance. Note – Not all columns add up exactly to 100 percent due to rounding error.**

Source: Data Adapted from BEIS (2019b)

5.10. Trust

The uncertainties that have been raised, lead to the related issue of who the public trust in relation to climate change communication. Individuals and groups are wary of certain groups, meaning they are unlikely to trust messages those sources are trying to portray. Consequently, the respondents within the first survey of this thesis were asked:

> *"How trustworthy do you think different people and organisations are in terms of communicating the truth about climate change?"*

Figure 5.17 shows the mean trust scores on a 5-point scale (1=not trustful at all, 5=very trustful) assigned by the respondents in relation to each source of information about climate change.

Figure 5.17 indicates an expected outcome that scientists and researchers are considered the most trusted source of information on climate change, with an average score of 4.08 out of 5, which is 0.58 greater than the wider education sector. These findings are consistent with other studies reporting high levels of trust in scientists (Funk and Kennedy, 2020). However, the standard deviation score for scientists and researchers is the third highest (0.56); this indicates there is some variation in perceptions amongst the respondents on the trustworthiness of information from scientists. This variation is likely to have its origins in those who either believe that climate change is not such a problem or have the belief that it is of natural origins, as had also been suggested by details in Section 5.2.

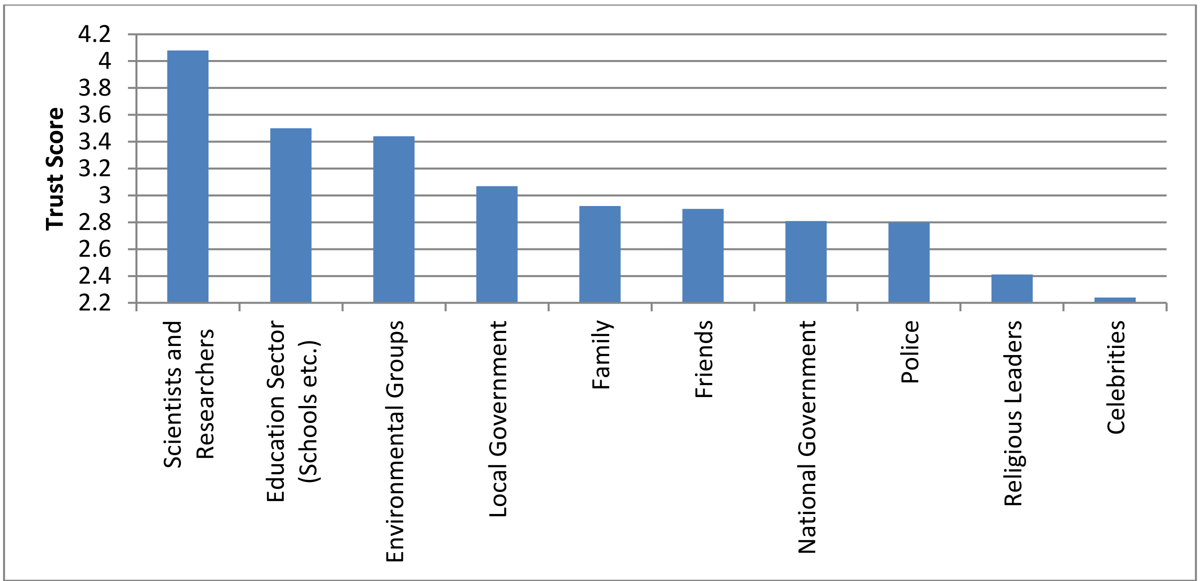


Figure 5.17 – Trust in Sources of Climate Change Information (Source: Author)

When examining the trust levels for the different age groups, Table 5.25 shows that across all age groups, ‘Scientists and Researchers’ are ranked as the most trustful of all the listed individuals or organisations. However, the level of trust in ‘Scientists and Researchers’, on average, declines with an increase in age. Table 5.27 also demonstrates that for the most part, the ‘education sector’ are the second most trusted in relation to communicating climate change, with ‘environmental groups’ third, the only exception being the age group ’55-64’, which had these the other way around. In terms of the least trusted for the age groups encompassing those over 35, are ‘celebrities’. However, the averages for ‘celebrities’ are greater for the older generations compared to the two youngest age groups. Within these two age groups, it is found that the least trusted for communication about climate change are 'religious leaders'. This is partly expected as the number of young people within the United Kingdom that have an irreligion belief[45] has been increasing in recent years.

Lastly, it is found that the average level of trust amongst the youngest age group within the survey was the lowest average amongst all nine different groups that were listed, with an average of 2.87. This compares with the most trustful generation, the 55-64 age group, who had an average of 3.12. The framing of trust applied will depend on whether related to good or bad forms of communicating climate change to younger people. Whilst this age group is the least trustful overall, they are the most trusting of 'scientists and researchers', who are theoretically the most likely to have detailed knowledge of the subject. This means, that scientists and researchers are important in delineating the issue of climate change, which could be done through varied mediums, such as television, public lectures, and social media.

Table 5.27 – Trust in sources of climate change information across age groups

	18-24	25-34	35-44	45-54	55-64	65+	All
Celebrities	2.15	2.17	2.27	2.22	2.38	2.23	**2.24**
Education Sector	3.53	3.70	3.62	3.43	3.48	3.41	**3.50**
Environmental Groups	3.51	3.47	3.43	3.36	3.51	3.39	**3.44**
Family	2.53	2.81	2.95	2.83	3.11	3.12	**2.92**
Friends	2.60	2.83	2.89	2.80	3.08	3.03	**2.90**
Local Government	2.77	2.96	3.06	2.95	3.27	3.23	**3.07**
National Government	2.75	2.81	2.81	2.73	2.90	2.83	**2.81**
Police	2.60	2.74	2.81	2.84	2.90	2.83	**2.80**
Religious Leaders	1.80	2.12	2.41	2.54	2.61	2.68	**2.41**
Scientist and Researchers	4.42	4.40	4.22	3.97	3.97	3.83	**4.08**
All	**2.87**	**3.00**	**3.05**	**2.97**	**3.12**	**3.06**	

Gold = Most Trusted Source; Silver = Second Trusted Source; Bronze = Third Trusted Source; Red = Least Trusted Source

Source: Author

5.10.1. Comparison to Past Trust Studies

As highlighted in section 3.2.4 of the thesis, a similar type of study was previously conducted in the city of Norwich in 1995 by Marris, Longford and O'Riodan (1996). whilst this study examined trust of institutions in the communication of environmental risk; it is arguable that climate change could be viewed as one of the greatest environmental risk of this current generation. Therefore, a comparison

[45] - This includes those with the belief of atheism, agnosticism and antitheism.

of the 1995 study with data collected within this thesis can provide a partial insight of how trust in different institutions has changed in the intervening two decades in relation to communicating environmental risks.

To achieve this analysis, the results from the trust question in the 2017 data were compiled into three different groups. The respondents who scored an institution with a trust score of either '1' or '2' were classified as 'Not Trustful'. The responses which received a trust score of either '4' or '5' were classified as 'Trustful'. Those that were classified truthful are demonstrated in Figure 5.18.

Figure 5.18 indicates that scientists were viewed as the most truthful source for climate change, for 77.3 per cent of the respondents. This compares with Figure 3.1, which demonstrates that in 1995 come over truthfulness of scientists being 60%. This demonstrates a 17.3% increase during the intervening period, this is despite an increasing level of attacks on the credibility of science within recent years [both within climate change and other scientific research as highlighted in section 3.2.4 and 3.3], which has led some scientists to state that is science creditability is under attack (Alexander, 2018; Boykoff, 2019).

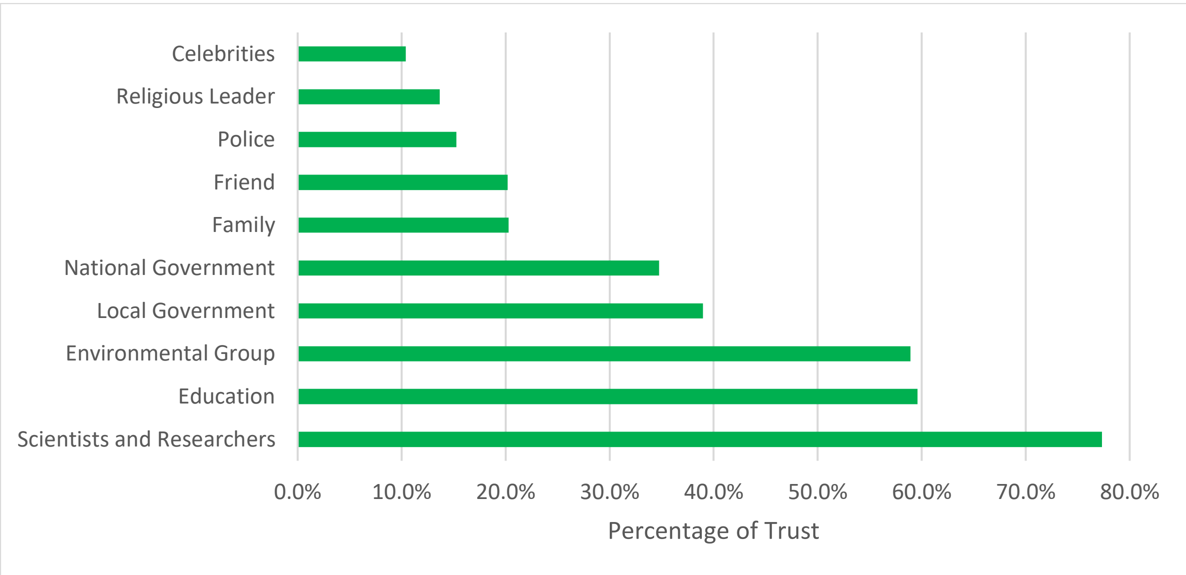


Figure 5.18 - The trustfulness in communicating climate change by different individuals and institutions according to respondents (Source: Author)

It is worth noting that the two biggest reductions in truthfulness in the intervening 22-year period is both friends and family, which in this study scored a trustfulness of only 20.2 and 20.3 percent, respectively. This is a stark difference when comparing to the 1995 study, with these two being the most trustworthy groups. It is arguable that this could be a demonstration of what Maibach *et al.,* (2016, p.1) termed the "climate spiral of silence". Since the 2017 survey, United Kingdom has seen the outbreak of civil disobedience by extinction rebellion, and school children striking in protest of a lack of action in relation to climate change by the national government. This combined with the increased media attention in recent years is due to the increasing urgent tone by climate scientists, could have resulted in greater trust amongst friends and family as conversations about issue of climate change will have increased. Therefore, there will be an even greater scope of research in this field in the years to come.

Whilst this section demonstrates that there has been a change in the nature of who the general public believes in communicating environmental risks, the relative low levels of trust in the national government is likely to have an impact on the perception of climate change policy that is set out by the national government. Therefore, researching the public perception of climate change and climate change policy interlinkages is very necessary.

5.11. Climate Change Policy

To effectively mitigate against the effects of climate change, legislation is important at all levels, from the global to local authority level. As chapter three highlights, the United Kingdom has policy agreements both at the national and international level to combat climate change in either a direct or indirect approach. However, politicians often find themselves battling with small margins between policy popularity and policy necessity. However, despite the importance of public reactions to climate change policy, research to understand the level of support amongst the British public is lacking.

5.11.1. Net Zero Policy

Within the last two years, an increasingly used term within policy on climate change within the United Kingdom is 'Net Zero', also known as carbon neutrality. This is due to the then Prime Minister, Theresa May, announcing a change to the Climate Change Act 2008, which legally increased the reductions of greenhouse gases emissions in the atmosphere from 80 per cent reduction by 2050, to 100 per cent reduction in the same time frame. This should therefore be a key terminology in relation of climate change within the United Kingdom. However, with it being such as new scheme in the United Kingdom, it has raised questions as to whether the public have heard or understand this scheme. Using the BEIS dataset that were collected in March 2020, just shortly before the COVID-19 pandemic induced lockdown, participants were asked "The Government promotes the concept of 'Net Zero'. Before today, how much if anything, did you know about this concept?". The respondents were given five options, with the results of this also been demonstratable in terms of the age groups.

Table 5.28 shows that a majority 66.5 per cent of respondents had not heard of the scheme previously. When exploring the age groups, it can be found that there is an 8.8 per cent significant difference between the lowest age group [55-64] and the highest [35-44] in having heard of the term 'Net Zero' ($\chi 2=4.8601$, $p=0.025^{**}$).

Table 5.28 – How many respondents in March 2020 have heard of the concept 'Net Zero'

	16-24	35-34	35-44	45-54	55-64	65+	Total
Hadn't heard about this before now	174 67.7%	189 65.6%	176 70.4%	163 66.0%	164 61.2%	355 67.4%	1,221 66.5%
Hardly anything but I've heard of this	35 13.6%	24 8.3%	27 10.8%	21 8.5%	26 9.7%	51 9.7%	184 10.0%
A little	22 8.6%	40 13.9%	19 7.6%	41 16.6%	37 13.8%	67 12.7%	226 12.3%
A fair amount	15 5.8%	26 9.0%	23 9.2%	16 6.5%	30 11.2%	43 8.2%	153 8.3%
A lot	11 4.3%	9 3.1%	5 2.0%	6 2.4%	11 4.1%	11 2.1%	53 2.9%
Total	257	288	250	247	268	527	1,837

Data Adapted from BEIS (2020b)

This demonstrates that the current communication of the government's new strategy in combatting climate change is not working. Consequently, this is likely to be fuelling the idea that the government is not doing enough in tackling climate change, which has recently led to further support for climate activism via a form of post-normal engagement that will be further explored in Chapter 7.

5.11.2. Fuel Duty

As in Chapter Three, Fuel Duty has been active since 1908 as a fuel tax. However, the British Government has been using it since 1992 as a method to increase efficiency of vehicles; by introducing the Fuel Price Escalator at three per cent, with the aim of reducing pollution from road transportation and improving the efficiency of vehicles. However, in recent years due to political pressures and financial recession, the rate of fuel duty has not been keeping up with inflation and it is now the responsibility of the Chancellor to determine the rise in Fuel Duty.

In relation to this, the respondents were asked the following question:

> *Currently, 57.95p per litre of petrol and diesel sold at petrol stations goes to the government in terms of Fuel Duty. In the past, it has been suggested that rises in Fuel Duty*

has resulted in increased efficiency of vehicles. How supportive would you be if the Government would want to increase Fuel Duty again in the next 12 months?

The question highlights how much they are currently paying in fuel duty and why fuel duty rises in the past have been good in terms of greenhouse gas emissions. They were given this information, as it is likely the public would not know how much fuel duty they were currently paying, and they might not know the previous relationship between fuel duty and the reduction of greenhouse gas emissions.

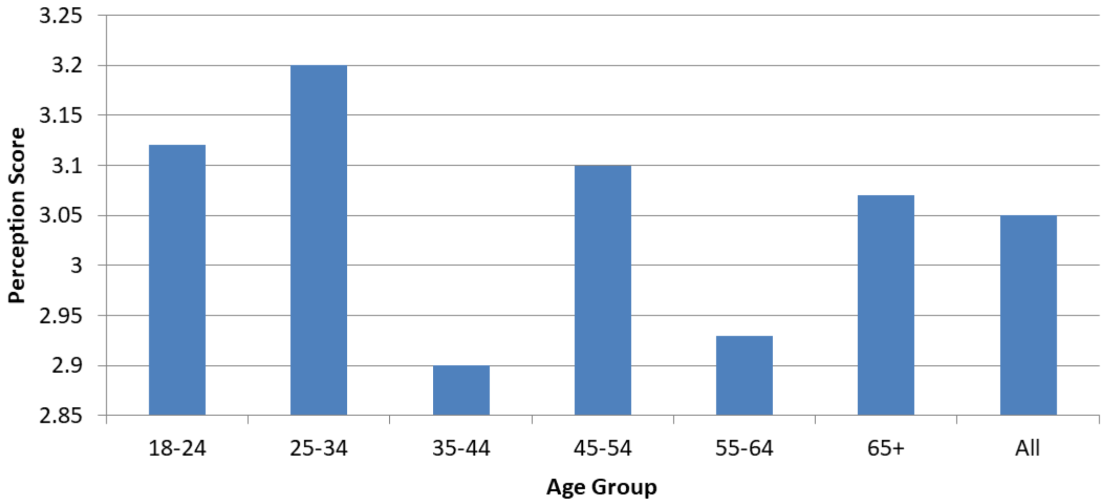


Figure 5.19 – Perception of potential increase in fuel duty (Source: Author)

As highlighted in Figure 5.19, the age group that are most in favour of raising of fuel duty within the next 12 months are the "25-34" age group, with the "35-44" age group been the least in favour. Nevertheless, this study was undertaken in 2017, since then the United Kingdom has entered a recession triggered by the COVID-19 pandemic. Further studies would be needed to see if this has had an impact on the public's perception of the merits of raising fuel duty due to climate change.

5.12. Summary

Overall, this chapter has demonstrated that there is an extremely high level of belief that the climate is changing [98.5 per cent in 2019]. In addition to this, it has been found that it is getting ranked as the greatest societal issues that the United Kingdom is currently facing. These high levels of perception that climate change is happening is ranked above other societal issues, demonstrating that findings from these respondents is highly likely to reflect that, across the country the public are generally taking the threat of climate change seriously. This chapter then demonstrated that not only do the public, particularly youth believe that the climate is changing, but only 10 per cent believe that it is purely down to natural causes. This means that a sizeable majority demonstrate that the public acknowledge that anthropogenic activity is playing a role in the changing climate. Despite this, only a small proportion of those surveyed believe that climate change is impacting in both their local area and at a national level; a greater focus in these samples is being placed on the global repercussions. Nonetheless, the main focus has being placed upon the impacts of the heatwaves and flooding, which have been witnessed as sizeable changes each year in the United Kingdom and depending on the weather just before the survey was undertaken, this reflects the here and now view of climate change that a population can have.

The view that climate change is a serious problem has been growing since roughly 2013, suggesting a social tipping point taking place. Consequently, this also brought to light that there was a social tipping point away from climate concerns before 2009; research suggests various influencing factors for the change including the economic climate or the lasting effects of climate change Despite this rise in concern, the United Kingdom, both overall and amongst youth, is still below average in terms of its scoring compared to the average showing for other parts of the European Union.

When exploring how the public views the impacts of climate change, their perceptions seem to be changing in response to recent extreme meteorological events that have occurred, conforming to past research. For example, during early 2019 the most chosen option was rising temperatures, with the survey occurring just after the winter temperature record had occurred roughly a fortnight previous. The following year, the most chosen option was flooding, which occurred after months of flooding that occurred in south/central England and Wales. The other major factor is that the most vulnerable in society [over 65s and poorest] are the least likely to believe that the impacts of climate change are currently occurring and also the least likely to believe that they are going to occur in the future.

In communicating climate change, this chapter has demonstrated that the respondents have very different beliefs about climate change, and that communication towards the public therefore needs to be done in various ways if it is to get a wider range of people engaged with the issue. It is suggested here that the scientific community could carry out more of the communication of climate change, as there are the most trusted group of individuals for climate change communication, whilst there is a widespread view that the media tends to exaggerate impacts of climate change.

Lastly, in terms of climate change policy, this chapter explored two strategies. For Fuel Duty, a contentious policy in the past, as demonstrated in 2000 or in 2017 in France, the majority of the respondents were in favour of raising Fuel Duty. However, the survey for this aspect was undertaken in 2017. With the economic instability that likely to persist even when the world returns to some sort of normality post-COVID-19 pandemic, the appetite of the public to policy schemes that raises their taxes will be likely be unpopular. For the 'Net Zero' scheme, a main UK goal in combatting climate change for the next thirty years, most of the respondents had not yet heard of it.

Chapter Six - Engagement of Climate Change

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“Save the Planet! What!? Are these f** people kidding me!? … The planet isn’t going anywhere? We Are! We are going away, so pack your s**t, folks. We wouldn’t leave much of a trace either. Just another failed mutation, just another closed end biological mistake. The planet will shake us off like a base case of fleas. A surface nuisance.”***

George Carlin, Comedian

Cited in Marshall (2014, p. 207)

Whilst the quote above has a very fatalist attitude towards climate change and environmentalism, it highlights an important point. Without action orientated engagement towards climate change, the very long-term effect is a potential threat to the survival of humanity and the environment, but not the planet. This highlights the importance of human engagement with climate change to both mitigate against climate change and adapt to it. This chapter examines levels of engagement towards climate change within the United Kingdom. Major themes include findings on mitigation, which includes sub-themes about responsibility of mitigation, how individual behaviours are already helping mitigate, how perceptions influence behaviours, and the case of transportation. The other main findings relate to education. This is further explored regards climate change as a sub-theme of education within the United Kingdom, public views about climate change being included in the national curriculum, and how a participatory education strategy, exemplified here by the ‘Yonmenkaigi System Method,’ can increase knowledge. It further considers whether the public want public lectures and workshops about climate change and engagement to integrate social issues with climate change.

6.1. Mitigation

As mentioned earlier in the glossary of this thesis, mitigation refers to the actions that can be undertaken to limit the magnitude and pace of climate change over the long-term period (Fisher *et al.,* 2007). Mitigation is to reduce the impacts and vulnerability of people toward extreme meteorological events. This is a positive action compared to adaptation, as the results of mitigation effects are felt globally; whereas the effects of adaptation can only be felt and observed at a local scale (Tol, 2003). However, the benefits of adaptation are going to be increasingly important, to decrease the vulnerabilities of people and increase their capacity to recover. When compared to climate mitigation in this way, mitigation is often invoked through the reduction of anthropogenic greenhouse gas emissions. Mitigation can be achieved in two different ways. The first is natural, through carbon sinks, and can be achieved through adaptations that increase these carbon sink capacities, as described within Section 2.1 of this thesis. Within the United Kingdom, there have been projects to achieve this through the restoration of peatland bogs and replanting of forests in the upland regions.

The driver is that it is critical for the population to reduce its greenhouse gas emissions, as there is only so much carbon that can be absorbed through carbon sinks, even with increasing capacity to reduce some emissions in recent years. It further raises an argument regarding who civil society think should be responsible for leading the efforts being made in combatting climate change.

6.1.1. Responsibility

Human activities that create greenhouse gas emissions contributing towards climate change are prevalent through Google searches, which provide evidence that explains that human activities contribute to greenhouse gas emissions. This also includes information about how individuals can change their behaviours, in an effort to reduce their greenhouse gas emission (Fibieger Byskov, 2019), as explored further in the next section. This seemly puts the emphasis of the problem on civil society in general. However, is it really the case that individuals are to blame? For example, a report by CDP (2017) highlights that since 1988, 71 per cent of all global greenhouse gas emissions have been caused by just 100 companies, a large proportion being coal and oil companies. Whilst many of these companies are producing goods that are particularly in public demand, these companies have the ability to transform their organisation to being more carbon neutral. For example, oil companies could diversify a new carbon neutral energy source, such as hydrogen or other forms of renewable energy.

This raises a question as to whether widespread individual behaviour can really cause significant enough change to limit greenhouse gas emissions. Cynically, it could be believed that for high polluting global businesses, the emphasis on what individuals can do to limit greenhouse gases has become convenient for major corporations. It is almost arguable that the term ‘human made’ climate change is incorrect, but ‘corporation made’ climate change would be a better fit.

Therefore, the respondents to a survey for this thesis were asked “which of these do you think should have the most responsibility for tackling the effects of climate change in the UK?” guided by the following four options:

1. The general public, by making changes to their lifestyle.
2. Businesses, by doing more to reduce their impact on the environment.
3. Government, by introducing more policies to reduce the levels of carbon emissions.
4. Can’t choose, all/more than one equal.

Figure 6.1 demonstrates the public's perception in both March 2019 and March 2020 of who they feel should be held most responsibility for tackling the effects of climate change within the United Kingdom. Within both surveys, it has been found that the most popular response is the government. However, the percentage increased by 2.9 per cent within the intervening one-year period, from 44 per cent to 46.9 per cent. Despite this increase between 2019 and 2020, there is no significant difference between the two samples (χ2=1.206, p=0.272). Antagonistically, whilst there is no significant difference, there are two potential differences to why this difference occurred. Firstly, the sample for the March 2020 was disrupted due to the COVID-19 pandemic, meaning that the proportion of the sample population might be slightly different compared to the March 2019 sample. The second, and a more plausible reason, is that the increased action been demanded by both Extinction Rebellion and the School Strike for Climate Change groups by the government to reduce the impacts of climate change via process of mitigation may have influenced public opinion.

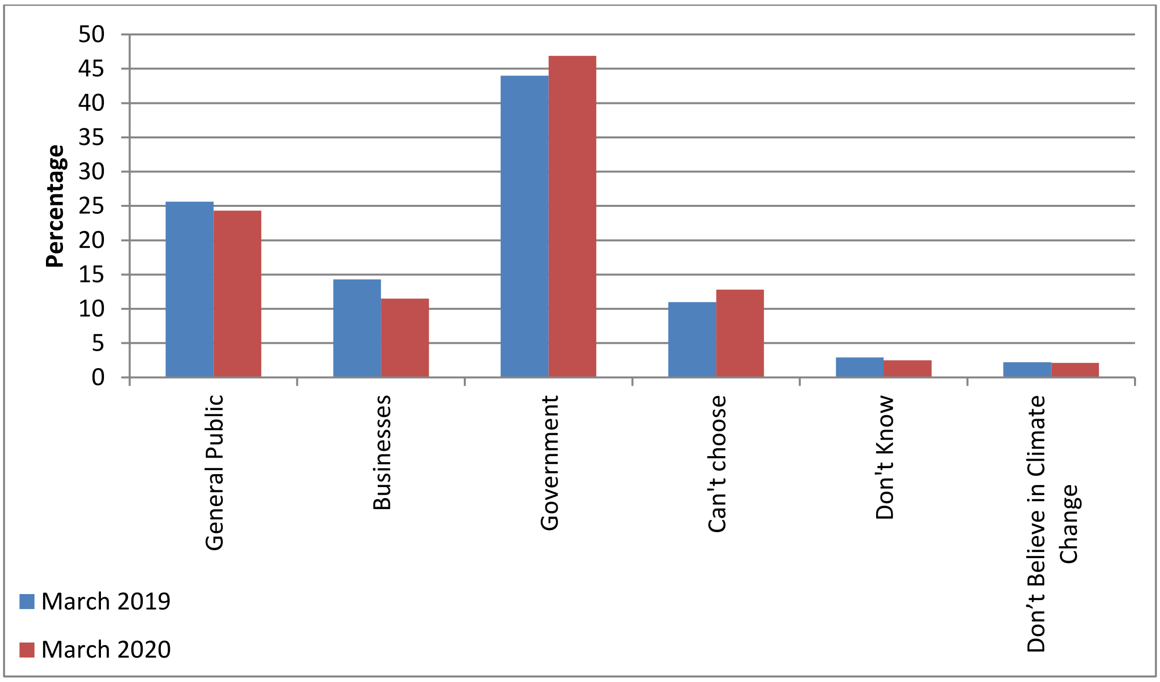


Figure 6.1 - Public perception of the responsibility to mitigate against climate change (Source: Data Adapted from BEIS, 2019b; BEIS 2020b).

As Figure 6.2 demonstrates, most of the increase has its origins amongst the young people [16-24], which has shown to have risen by 10.4 per cent in the same intervening period for the choice of government, significantly from 42.5 per cent to 52.9 per cent (χ2=7.246, p=0.007***).

At the same time, the level of belief that businesses should take the most responsibility has reduced by 2.8 per cent from 14.3 per cent to 11.5 per cent. This makes the response the least of the main three responses, and potentially has demonstrated that businesses have potentially done a good job (from their perspective) of avoiding responsibility. However, the rise in expectation on government could in part be a result of the public wanting the government to legislate against big businesses.

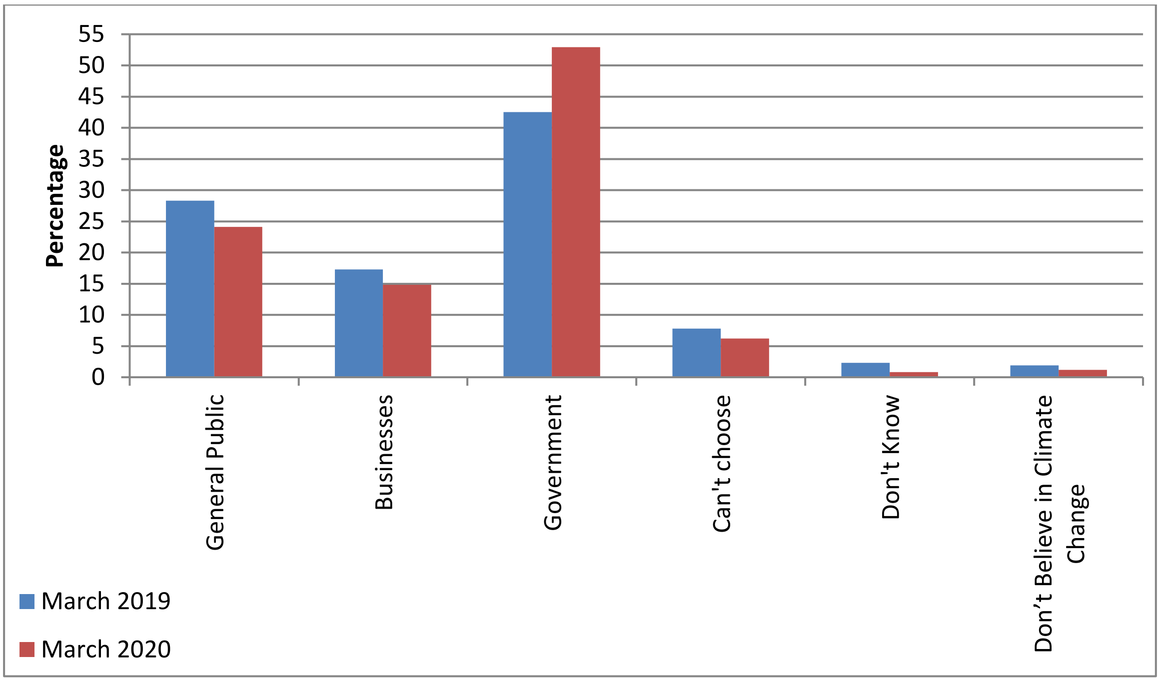


Figure 6.2 – Young People's perception on the responsibility to mitigate against climate change (Source: Data Adapted from BEIS, 2019b; BEIS 2020b).

6.1.2. Individual Behaviours

As highlighted earlier, mitigation orientated engagement is crucial if the world is going to meet the Paris Agreement's 2ºC goal. As also demonstrated within the previous section, a number of people (24.3 per cent in March 2020) think that individuals in the general public are the most responsible for tackling the effects of climate change within the United Kingdom by making changes to their lifestyle. However, this raises questions as to whether the public are already starting the challenge of changing their lifestyle to help mitigate climate change.

Regarding lifestyle change, respondents within the first questionnaire of this thesis, between March and September 2017, were asked "which of the following have you undertaken in the last three years, which have reduced your contribution towards climate change?". The respondents were given nineteen different options to choose from, including having an electric vehicle to eating less meat. When coming to the analysis of the responses, each of the nineteen responses that were provided to the respondents can be split into three overall categories. There are three different types of mitigation, being "behavioural changes with no capital investment", highlighted in yellow; "behavioural changes with minor capital investment", highlighted in blue; and "behaviour changes with major capital investment", highlighted in green. The overall responses to each of the different mitigation strategies are shown in Table 6.1.

Table 6.1 – Mitigation strategies being undertaken in the last three years, from the survey undertaken in 2017

Mitigation	Number of Responses	
Recycle Waste	**994**	87.7%
Switch off lights	**929**	81.9%
Install low energy light bulbs	**889**	78.4%
Turn down heating	**763**	67.3%
Buy food with less packaging	**654**	57.7%
Buy locally grown food	**599**	52.8%
Reduce personal waste production	**588**	51.9%
Unplug appliance when not used	**585**	51.6%
Usage of Public Transport (e.g. Bus, Train)	**547**	48.2%
Use water sparingly	**527**	46.5%
Install house insulation	**497**	43.8%
Making fewer car journeys	**450**	39.7%
Walk or Cycle to work	**430**	37.9%
Eat less meat	**414**	36.5%
Buy second hand products	**337**	29.7%
Grow your own food	**301**	26.5%
Install renewable energy	**191**	16.8%
Car share to work	**101**	8.9%
Driving an electric/hybrid car	**74**	6.5%

Source: Author.

It can be observed within Table 6.1 that easy to implement behavioural changes, such as recycling waste and switching off lights, are the two most undertaken mitigation responses amongst the respondents. It is likely that these two actions scored highly due to ease of habit, such that the switching off lights is a behavioural mitigation strategy that is taught to many young children from an early age, either at home or at school. It is apparent that most people do it naturally, such that they do not necessarily think about it. However, it also could be due a practicality choice confronting people and requiring changed behaviour. In addition, an individual might want to undertake behavioural mitigation strategies such as 'switch off lights' and 'turn down lights' due to the fact these mitigation strategies can save the respondent some money each year. In terms of recycling, some councils in recent years have moved toward fortnightly bin collections, meaning an increased necessity to make use of this recycling service provided and nudging behaviour change to makes use of the recycling service. Naturally, these types of strategies will be more successful, as for the majority of the public, saving money and making use of something they pay for in any case, will always be attractive, particularly to those who are financially not as well off.

In addition, there is a difference between the average response rates between behavioural change with no capital investment and behavioural change with major capital investment within Table 6.2. This is demonstrated as average response rates for behavioural change was 51.0 per cent, whereas behavioural change with major capital investment averaged at 22.4 per cent. As a result, there is a significant difference between these two groups at the 99 per cent significance ($\chi 2$=865.960 p=0.000***).

It has been highlighted so far, that the most undertaken mitigation strategies are those either of behavioural changes or those strategies that will in the short to medium term save the respondents money. This is especially observed for the "install low energy light bulbs" which is ranked third overall at 78.4 per cent. In addition, this is the highest in the group that requires minor capital investment. This is due to the low cost of the mitigation strategy, despite low energy light bulbs, such as LED, being more expensive to buy at first. However, when applying a cost benefit analysis, it is found that after a few years, they have paid back this cost and are saving money.

When exploring these differing levels of engagement between the different age groups, it is found that in terms of behavioural changes only, the two youngest age groups are much more likely to undertake the behavioural changes that require either no or minor capital investment, as these are the only groups ranking above 50 per cent. After these two age groups, there is no discernible pattern or significant differences between the age groups. However, when observing the differences between the age groups that need both minor and major capital investment, there is an increase for each age group. A 10.9 per cent increase between the age groups '18-24' and 65+' reflects how the older respondents have a higher reserve of capital to invest in these mitigation strategies.

The thesis so far has addressed in what way there are differences between respondents based upon their age. Therefore, Table 6.3 demonstrates the most and least undertaken mitigation strategy based upon differing age groups in 2017. It is found that for all age groups, except for the age group '18-24', the most popular choice was recycling waste. The exception of that age group in this ranking was in part due to the very high percentage response in the number of young people undertaking the mitigation strategy of switching off lights when not in use. This is a clear demonstration of the earlier mentioned mitigation behaviour strategies that are adopted in early education. It has also been demonstrated that apart from the age group '55-64' and '65+', the least undertaken mitigation strategy in 2017 is driving an electric or hybrid car. There are two potential reasons for this; firstly, that this type of investment is high, and it is more likely that more elderly respondents are going to potentially have the level of financial capital necessary to buy these vehicles. Secondly, car shares to work are lower in these categories, as these are the two age categories that have lower proportions that will be working, as they are nearing or past retirement age.

Table 6.2 – Mitigation changes depending on age groups

Age Group	Behavioural Change with No Capital Investment	Behavioural Change with Minor Capital Investment	Behavioural Change with Major Capital Investment	Behavioural Change with ANY Capital Investment	Average
18-24	55.8%	42.6%	11.7%	**32.3%**	**44.7%**
25-34	52.5%	51.8%	10.8%	**38.1%**	**48.2%**
35-44	47.6%	47.2%	19.7%	**38.1%**	**43.1%**
45-54	50.7%	49.7%	23.0%	**40.8%**	**46.0%**
55-64	50.2%	50.4%	28.2%	**43.0%**	**46.8%**
65+	47.2%	49.6%	30.3%	**43.2%**	**45.3%**
Overall	**51.0%**	**48.9%**	**22.4%**	**40.1%**	**45.8%**

Source: Author

Table 6.3 – Most and least undertaken mitigation strategies in 2017 depending on age group

Age Group	Most Undertaken	Least Undertaken
18-24	Switch Off Lights 93.3%	Driving an electric/hybrid Car 4.3%
25-34	Recycling Waste/Switch Off Lights 87.4%	Driving an electric/hybrid Car 6.0%
35-44	Recycling Waste 83.5%	Driving an electric/hybrid Car 6.1%
45-54	Recycling Waste 85.1%	Driving an electric/hybrid Car 3.6%
55-64	Recycling Waste 89.6%	Car Share to Work 5.7%
65+	Recycling Waste 87.8%	Car Share to Work 5.6%

Source: Author

So far, this section has determined that the uptake of certain mitigation strategies varies by age group, especially due to financial capability. The conceptual framework within Section 3.10 highlighted that engagement behaviour in association with climate change mitigation and adaption can also be influenced by an individual's perception towards climate change. The theory is that the more serious the perception of the impacts of climate change, the more engaged people will be in reducing it. The remainder of this sub-section examines the extent to which engagement behaviour of a wider sample of the public and the respondents within the primary data surveys of this thesis is influenced by their perception of climate change. To undertake this, the data from the 2019 Eurobarometer has been used. This data has been used because the seriousness score, as used within Section 5.5 of this thesis is a good measure to determine how much of a threat the respondents believe climate change poses. The results are ranked using a Likert Scale between 1 and 10, with 1 meaning 'not at all a serious problem' to 10 meaning 'an extremely serious problem'. To be able to make a meaningful comparison, the data about the seriousness needs to be combined into smaller groups; accordingly, three groups have been created, as demonstrated within Table 6.4. Those respondents within the Eurobarometer (2019) that scored climate change seriousness between 1 and 4, are grouped within the 'not a serious problem' group, between 5 and 6 'a fairly serious problem' and between 7 and 10 'a very serious problem'. Those respondents who recorded not knowing in the seriousness score are excluded from this analysis.

For the different mitigation changes that the respondents were questioned about, they were again divided by whether they needed a financial investment to undertake these strategies or not. The mitigation strategies are broken up into three groups, with blue meaning products or services for which the majority of the public regularly (within every ten years) make an investment. For example, householders will buy food or switch energy suppliers frequently compared to buying an electric car or installing insulation in their home.

Table 6.4 demonstrates that for all groups that make behavioural changes [yellow], those who view climate change 'a very serious problem' are more likely to undertake these mitigation strategies compared to the other two seriousness groups. Also, the top three most carried out mitigation actions within Table 6.4 are repetitive behavioural changes for day-to-day life. Whilst people find these the easiest to change, they show there are some large differences between the 'not a serious problem' and 'a very serious problem' groups, with a 29.8 per cent gap between the two for the mitigation strategy of regularly using environmentally friendly alternatives to cars (99 per cent significant).

Only 31.6 per cent of respondents agreed that they had adopted the behavioural change mitigation strategy 'installed equipment in your home to control and reduce your energy consumption'. There is a 10.7 per cent difference between those indicating 'not a serious problem' and 'a very serious problem', and that is significant again, but only at the 90 per cent level, whereas all other behavioural changes show a 99 per cent significant difference. There are two potential reasons for this, the first being the inclusion of this mitigation strategy within the behavioural change [yellow] category, which might be contested, as some of this change required a small financial investment beyond behaviour.

However, it is included within this behavioural change section, as smart meters were listed within the questionnaire, and smart meters within the United Kingdom are free to every household, being designed to change people's behaviour by informing them as to how much energy they are consuming throughout the day. The other potential reasons for this difference are that usage of smart meters within the United Kingdom and numerous other countries has raised potential security issues through cyber-attacks (Anderson and Fuloria, 2010), data privacy in relation to behavioural patterns of occupants (Chadwick, Butt and Cook, 2012), fire risks being reported within Canada and the United States (CBC News, 2014; Sickinger, 2014) and health issues related to pulsed radiofrequency radiation (Hess and Coley, 2014).

In terms of mitigation strategies that require small amounts of financial capital, it was found that similar differences between the levels of seriousness groups occurred, with the 'a very serious problem' group scoring significantly higher (99 per cent level in all cases). The likelihood is that these were significantly higher as they usually do not cost much and are the respondents that are likely to have needed to invest in these mitigation strategies within the near future, and in the most part will likely lead to financial savings in the medium to long term future.

For the mitigation changes that require a large amount of a financial investment, the results are more variable. This is demonstrated in two different ways. Firstly, it is found that none of these strategies reveal significant differences between the different seriousness groups. Further, for two of the four mitigation strategies ['installation of insulation' and 'buying an electric car'] a higher proportion indicate 'not a serious problem' than 'a very serious problem'.

These results throughout this section are suggesting that perception does influence engagement towards more environmental, climate conscious behaviour. They are consistent with there being a linkage between perception and engagement within the conceptual framework (Section 3.10). However, results in this thesis have also demonstrated that there are external factors missing from the conceptual framework, specifically in this case 'household income' or economic influences. The results within this section already show that some of the best methods in reducing greenhouse gas emissions are expensive and limit the ability of society to engage those strategies, even though significant proportions of people demonstrate a willingness to change their behaviour.

As highlighted, there are at least nineteen different mitigation strategies within this thesis that could be reported. For focus and brevity, the theme of transport is examined further here.

Table 6.4 – Mitigation strategy changes in relation to views about the seriousness of climate change, 2019

	Not a serious problem	A fairly serious problem	A very serious problem	Total	Sig.
You try to reduce your waste and you regularly separate it for recycling	57 67.9%	128 78.0%	697 87.9%	882 84.7%	0.000 ***
You try to cut down on your consumption of disposable items whenever possible e.g. plastic bags from supermarket, excessive packaging	34 40.5%	87 53.0%	578 72.9%	699 67.1%	0.000 ***
You regularly use environmentally-friendly alternatives to your private car such as walking, cycling, taking public transport or car-sharing	20 23.8%	51 31.1%	425 53.6%	496 47.6%	0.000 ***
When buying a new household appliance e.g. washing machine, fridge or TV, lower energy consumption is an important factor in your choice	21 25.0%	63 38.4%	376 47.4%	460 44.2%	0.000 ***
You have insulated your home better to reduce your energy consumption	34 40.5%	58 35.4%	289 36.4%	381 36.6%	0.719
You have installed equipment in your home to control and reduce your energy consumption (e.g. smart meter)	19 22.6%	46 28.0%	264 33.3%	329 31.6%	0.077 *
You consider the carbon footprint of your food purchases and sometimes adapt your shopping accordingly	13 15.5%	27 16.5%	261 32.9%	301 28.9%	0.000 ***
You have switched to an energy supplier which offers a greater share of energy from renewable sources than your previous one	11 13.1%	28 17.1%	204 25.7%	243 23.3%	0.003 ***
You consider the carbon footprint of your transport when planning your holiday and other longer distance travel and sometimes adapt your plans accordingly	8 9.5%	13 7.9%	175 22.1%	196 18.8%	0.000 ***
You have bought a new car and its low fuel consumption was an important factor in your choice	12 14.3%	27 16.5%	151 19.0%	190 18.3%	0.456
You have bought a low-energy home	5 6.0%	9 5.5%	58 7.3%	72 6.9%	0.658
You have bought an electric car	4 4.8%	2 1.2%	24 3.0%	30 2.9%	0.254
Total number of Respondents	**84**	**164**	**793**	**1,041**	

Yellow Cells = Behavioural Changes; Green Cells = Behavioural Changes with Large Capital Investments; Blue Cells = Behavioural Changes with Small Capital Investments or Investments Frequently Required; Sig. = Significant; * = 90 per cent significance; * = 99 per cent significance.**

Source: Data Adapted from Eurobarometer (2019)

6.1.3. Transport

During the research for this thesis, a common theme of transportation cropped up, not surprisingly, as transportation makes up such a high per cent of the United Kingdom's greenhouse gas emissions. In 2018 this was 27.2 per cent. Therefore, the reductions of these emissions will be important if the United Kingdom is going to meet its 2050 target of being net zero.

As demonstrated within Figure 6.3, the overall movement of people using motorised transportation in the United Kingdom has increased nearly every year since records began in 1952. Between 1952 and 2018, passenger numbers on trains, buses and coaches declined by 62 per cent; at the same time cars, vans and taxis for person transportation have increased (DfT, 2018).

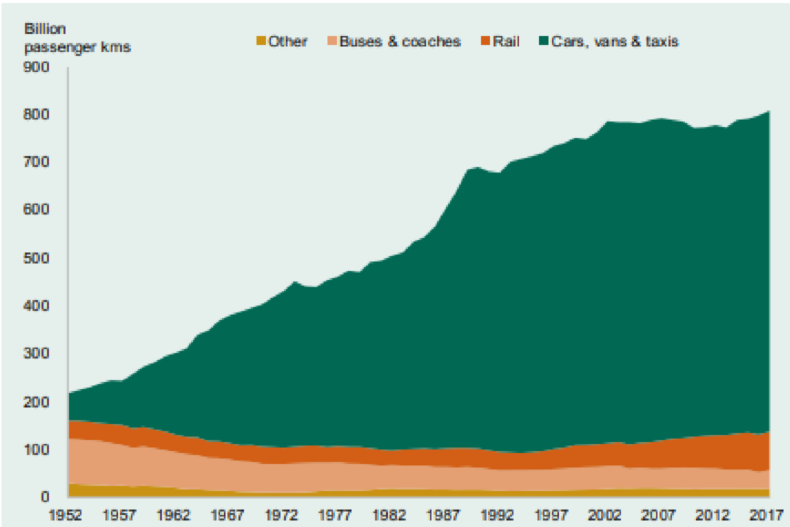


Figure 6.3 – Passenger Kilometres by Mode within Great Britain between 1952 to 2017 (DfT, 2018, p.4)

In order to reduce carbon emissions from the transportation sector, changes will have to be in part the responsibility of the public. There are varying ways in which civil society will be able to reduce their own personal emissions from transportation, including: walking more, taking public transportation and buying less carbon pollutant vehicles. Despite all this, it raises questions surrounding what do the public believe is the biggest overall contributor to climate change within the United Kingdom from the transportation section. Therefore, using the National Travel Attitudes Study [England], the respondents were asked "which of the following do you believe is the biggest contributor to climate change?" (DfT, 2020). As demonstrated within Figure 6.4, the respondents within England believed that 'Vans and Lorries' was the largest contributor [29 per cent], with cars following with 23 per cent. This is despite official figures from DfT (2019) highlighting that the cars, within 2018, completed 186.9 billion more vehicle miles compared to Vans and Lorries [or 274.4 per cent more].

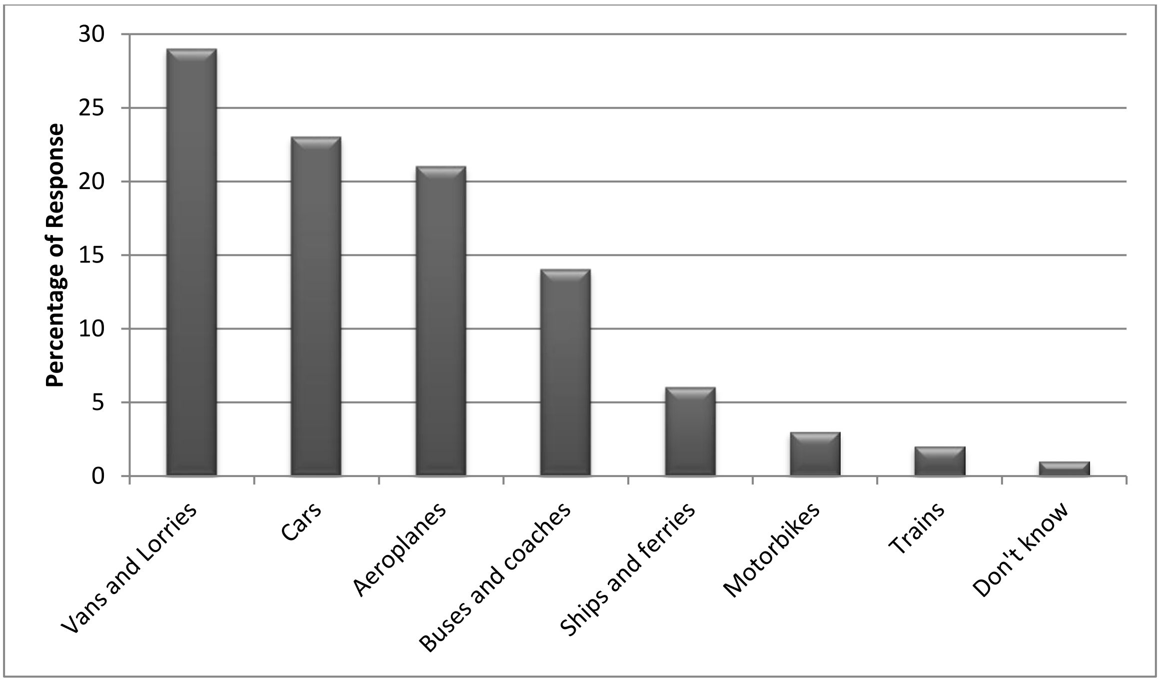


Figure 6.4 – Proportion of respondents that felt each mode of transportation was the biggest contributor to climate change (Source: Data Adapted from DfT, 2019)

6.1.3.1. Cost of Public Transportation

The most common discussion point surrounds the usage of public transportation is the costs. This is demonstrated by respondent OLB025 who gives the opinion that "current costs are ridiculous and not competitive with private car use. A train ticket from Laurence Kirk to Aberdeen is £16" [Female, 35-44, Scotland]. The distance between Laurencekirk and Aberdeen is roughly 30 miles and is roughly a half an hour journey. The problems surround the cost of public transportation has been raised in the last few years by the media (Stone, 2015; Wyporska, 2017). In one extreme case highlighted in 2019 by The Independent, a return ticket between Stockport [Manchester] to London was £287.50, which was £2.50 more expensive for a return flight between London and New York (Coffey, 2019).

The issue of train costs is due to the above inflation rises that have happened year on year for the last few years. In a report by the Department for Transport [DfT] (2017a) it was highlighted that the Rail Fare Index has increased between 1995 and 2017 by 121.3 per cent; with long-distances journey fares rising at the fastest rate of 150.9 per cent during this period. This means with inflation accounted, fares have increased nationally by 21.8 per cent in real terms between 1995 and 2017. However, as demonstrated in Figure 6.5, the fares in 2016 and 2017 also increased, but lower than the Retail Price Index[46] (RPI).

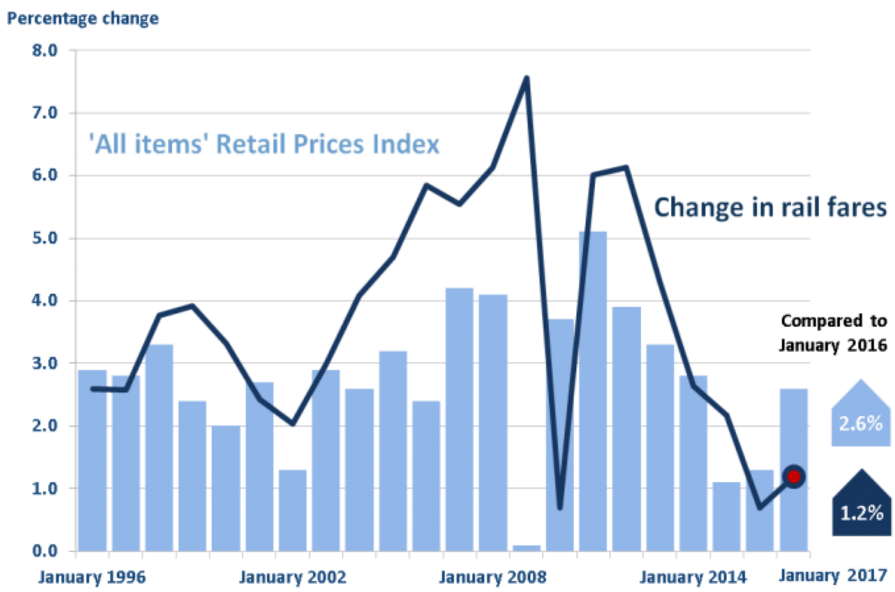


Figure 6.5 – RPI compared to Rail Fares between 1996 and 2017 (DfT, 2017a)

In a joint study by Voucher and the Daily Mirror in 2017, it was found that the cost of trains within the United Kingdom were the most expensive in Europe. For example, it was found that the average cost £0.50 per mile within the United Kingdom; whilst the next nearest is Austria at £0.41 per mile; with Italy the cheapest at £0.15 per mile (Munbodh, 2017).

These perceptions about the affordability of trains are not limited to the questionnaire in this study. Using data collected from the DfT (2020) within the national travel attitudes study [England], the respondents, between August and September 2019, were asked 'how affordable or unaffordable do you think the following forms of transport are?'. As demonstrated within Figure 6.6, that the train was ranked as the least affordable mode of transportation, with a net affordability of 36 per cent. This compares to the personal vehicle [the most pollutant on the list], which had a net affordability of 72 per cent. This demonstrates that despite the majority of the public perceive trains to be the form of transport least contributing to climate change, it is unaffordable to many. This is especially so for younger people, who tend to be the least affluent in society. As earlier in the chapter suggests, young

[46] - Retail Price Index is a measurement of inflation and uses the change in cost of goods and services from a represented sample

people tend to be the most concerned within society, but without the disposable income of the older generations have, they are limited in their choices in the mode of transportation.

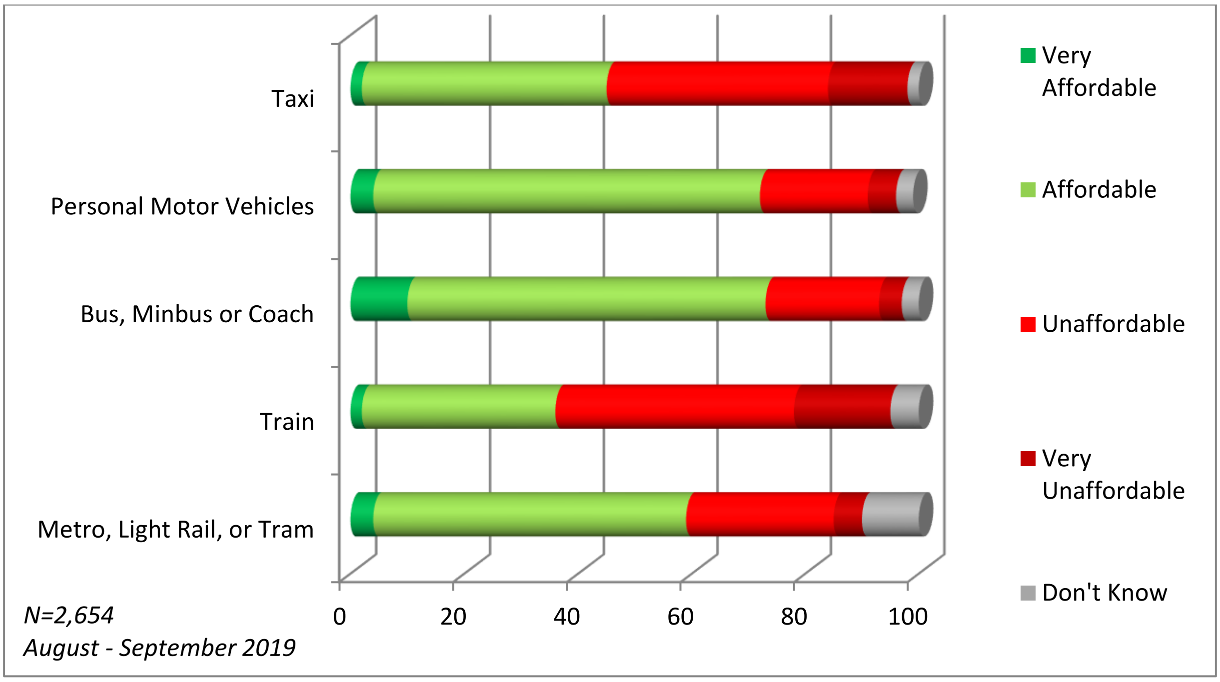


Figure 6.6 – Perception of Affordability of Transportation in England between August and September 2019 (Source: Data Adapted from DfT, 2020)

Despite this, it has been found by the DfT (2017b) that the number of rail journeys within England has been increasing since 2002, with an increase of 56 per cent between 2002 and 2016. This means that on average people within the United Kingdom now take 21 trains journeys each year. In addition, on average the public are now traveling 23 per cent more on trains in 2016 than in 2002.

The issue of public transport is not just limited to trains; the respondents have raised some issues with bus services as well. Again, the issue of cost is seemingly a major issue. For example, one respondent [OLA228] states that "the local bus service costs more than £5 for a return (3 miles), therefore much more expensive for a family of 4 to use than a car" [Female, 35-44, North East England]. This demonstrates that people are willing to change but still use their car more, which will increase greenhouse gas emissions.

Within England, the average prices of bus fares have risen by 66 per cent between March 2005 and March 2017, at the same time, the RPI only rose by 41 per cent during the same time period (DfT, 2017c). This is demonstrated in Figure 6.7, which shows that the Local Bus Fares index[47] was constantly

[47] - Local Bus Fares Index provides a measurement of change in fares that charged by bus companies

higher than the RPI. However, since the first quarter of 2016, the Local Bus Fares index has fallen behind the RPI. It is also noted that since 2012, the Local Bus Fares index has been falling, which means that the amount that bus fares have been raising, is less in 2016 compared to 2012. It should be noted that the Local Bus Fares index is only for England, whereas the RPI is for the United Kingdom as a whole.

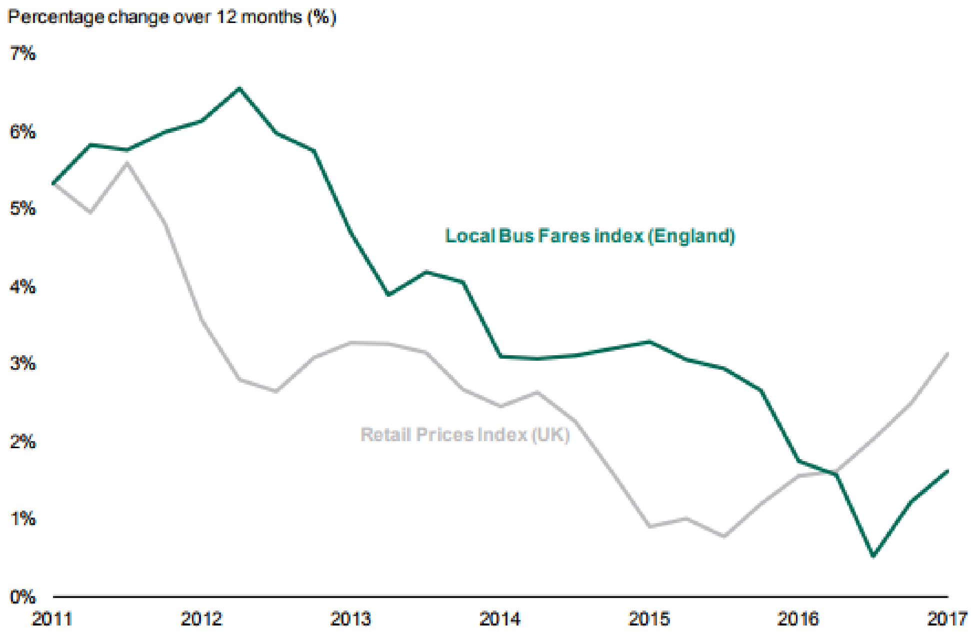


Figure 6.7 – 12 Month Average Percentage Change of the Local Bus Fare Index [England] Compared to the Retail Price Index [UK] between 2011 and 2017 (Source: DfT, 2017c, Online)

It is also demonstrated in DfT (2017c) that the bus fare increases are not constant across England, with bus fares in metropolitan areas, such as Birmingham and Manchester, increasing by 80 per cent. This compares to an increase of 53 per cent in non-metropolitan areas.

6.2. Education

As highlighted within Section 3.4, it is important that the education sector teaches and explains the dangers of climate change and how best to mitigate against and adapt to future climate change. This is especially so for young people under the 18 years old. It is possible that they will be the first in which all young people will learn in detail about the changes that are suspected of being behind many of the extreme meteorological events seen on television news.

With climate change expected to have the largest impact on the youngest in society, it would be expected that this issue should be an important topic for the education sector within the United Kingdom to tackle.

Currently, the government set out a curriculum for Key Stage 3, which states climate a couple of times including "weather and climate, including the change in climate from the Ice Age to the present" and "understand how human and physical processes interact to influences, and change … the climate; and how human activity relies on effective function of natural systems" [DfE, 2013b, p. 2]. These statements mention elements of climate change within the specification, but do not mention it in name and do not mention that the students will be taught best practice behaviour. However, with increasing number of schools within the United Kingdom, especially in England, becoming academies, they are not required to follow the national curriculum set out by the government (DfE, No Date), meaning that these schools might be teaching more than the national curriculum sets out. Alternatively, it also increases the possibility of schools not teaching any element of climate change or even being influenced by stances on climate denial. The actual levels of teaching of climate change at younger ages are not very well determined.

When the students get to Key Stage 4 and 5, they are required to follow the specification of teaching that the exam boards set. Upon examining the specification laid out by the examination boards, the students are expected to have detailed knowledge of the carbon cycle, how humans are interfering with it due to cause climate change, how to best mitigate against and adapt to climate change, and how international climate change policy is determined via COP climate conferences. This demonstrates that those who end up taking geography for GCSE and A-level within England will have a detailed knowledge of climate change.

Despite these examples of climate change in the national curriculum, opinion pieces in *The Guardian* (Harvey, 2020) and respondents within both surveys do not believe that climate change is taught enough within the national curriculum. Respondent OLA017, calls for "more education about exactly what might happen, why we should care and how it might affect us personally" [Female, 18-24, East Midlands].

This is backed up by a survey conducted by YouGov for Oxfam, which found that 69 per cent of teachers within the United Kingdom believe that climate change should be taught more on the national curriculum. Twenty-five per cent say that it is the right amount and 3 per cent believe that it should be taught less (Taylor, 2019).

Despite teachers, members of the media and more generally amongst the public calling for more teaching, the inclusion of climate change has been controversial for over the past decade (see Section 3.4). As demonstrated throughout Chapter 5, there are still some people that do not believe climate change is happening. Consequently, there will be always be a cohort of people who do not think it should be taught at school. In January 2020, YouGov asked respondents "do you think learning about climate change should be part of the school curriculum?". As demonstrated within Table 6.5, the majority [77 per cent] believe that climate change should be a part of the national curriculum taught in schools. The youngest surveyed [18-24 year olds] were the least likely to believe that it should [72 per cent]. Whilst they are still part of the majority of those supporting teaching climate change, a question is raised as to why young people were 7 per cent less likely to believe that climate change should be taught in schools compared the oldest in society [65+]. As the survey did not asked any follow up questions, this remains unknown.

Table 6.5 – Should climate change be taught more in the national curriculum

	16-24	**25-49**	**50-64**	**65+**	**Overall**
It should	72%	77%	78%	79%	77%
It should not	16%	9%	11%	11%	11%
Don't Know	12%	14%	11%	10%	12%

N= 2,579; Survey Collection = 22nd January 2020

Data Adapted from YouGov (2020c)

It is demonstrated within Table 6.6 that the majority of the respondents believe that climate change should be taught in secondary school [83.2 per cent]. Overall, there seem to be a slight gulf between compulsory education and voluntary, with college and university levels being 15.5 per cent and 18.6 per cent lower respectively compared to secondary school. Whilst, the survey does not ask why they have made these choices, it is likely to be due to people thinking that further and higher education should be focused on the qualification they are trying to achieve, rather than issues such as climate change.

Table 6.6 – What level should climate change be taught at in formal education.

	Primary School	**Secondary School**	**College**	**University**
Overall	896 (79.0%)	943 (83.2%)	768 (67.7%)	733 (64.6%)
18-24	137 (84.0%)	150 (92.0%)	125 (76.7%)	105 (64.4%)
25-34	128 (84.8%)	130 (86.1%)	110 (72.8%)	106 (70.2%)
35-44	92 (80.0%)	97 (84.3%)	74 (64.3%)	72 (62.6%)
45-54	125 (74.4%)	128 (76.2%)	100 (59.5%)	102 (60.7%)
55-64	184 (80.0%)	190 (82.6%)	152 (66.1%)	142 (61.7%)
65+	226 (74.8%)	246 (81.5%)	205 (67.9%)	203 (67.2%)
Male	511 (75.5%)	555 (82.0%)	438 (64.7%)	420 (62.0%)
Female	377 (84.2%)	382 (85.3%)	325 (72.5%)	307 (68.5%)

Source: Author

6.3. Yonmenkaigi System Method for Education

As highlighted so far in this thesis, the education of climate change is felt to be somewhat limited in the curriculum, especially at the secondary levels and colleges. In addition, when being taught, there is evidence that student discussion is being stifled (Seow and Ho, 2016). This was also highlighted by Interviewee 1, who recalls an incident when being taught about climate change at school, where a fellow student asked about natural climate change. The teacher of the class was very dismissive of the argument and they remember that the student "did not have much more to say on the issue for the rest of that semester, did not really participate at all", as they "think that maybe it was a case that they embarrassed them" [18-24, Female, Scotland].

Education in the United Kingdom is broadly provided in a way which either uses a video or is about being talked to by a teacher. Consequently, it could be that the student is taught about climate change but is not necessarily participating in learning of climate change. Therefore, the research for this thesis engaged a participatory method called 'Yonmenkaigi System Method' as a potential way for future education to create debate about climate change within the education system. As introduced earlier in chapter four as a method, the Yonmenkaigi System Method experiment was undertaken with sixteen first year Environmental Management students on their first week of university on the 8th October 2018.

6.3.1. Why Use Yonmenkaigi System Method in Climate Change Education?

The Yonmenkaigi System Method is highlighted in Section 4.7 as multi-step approach which allows the students/participants to engage with climate change. It needs to be acknowledged that there are many different participatory methods that could have been used. However, this method was chosen for various reasons.

Firstly, this method was designed with the idea of mitigating and adapting to disaster on a local scale in mind; especially since it was first designed in the mid-1980s and became more prominent post-Great Hanshin Earthquake in January 1995. Whilst it could be debated whether climate change is a hazard or a driving force of a hazard, it can be asserted that climate change is slow onset disaster with often rapid onset impacts. As highlighted earlier, this method has been used in disaster affected communities in the past to study what can be done better (i.e., build-back-better). There are examples of it being used in Mumbai, India (Samaddar *et al.,* 2015); Kyoto, Japan (Okada *et al.,* 2013); and Garisan-ri, South Korea (Na, 2016).

The second reason is the process of the accompanying workshop allows for more engagement of more disinclined speakers. In every classroom situation, students have varying levels of confidence. Due to the nature of splitting the group into much smaller sizes of only 4, this gives the student more confidence to speak. This process in which the students are broken down into small groups of four students to discuss and debate the best approach in certain timescales is a participatory teaching approach called 'think-pair-share'. Think-pair-share was originally developed as a co-operative learning technique in 1981 by Dr. Frank Lyman. However, in this case, it is more like 'think-square-share', as the 'pair' in the title usually suggests two, whereas there are four people (square) within this exercise for each of the four elements of the Yonmenkaigi Chart.

Lastly, is as highlighted earlier, this method has its origins in Japan. Traditionally, Japanese culture has been viewed to be at one with nature, in which people view nature as source of beauty and to be appreciated, rather than the destructive force in which it is viewed sometimes in western culture (Crossley-Baxter, 2020). Cyranoski (2010) states this is demonstrated through 'The Great Wave off Kanagawa', in which people in the picture do not look panicked by the tsunami whilst riding the wave. The nature of the Yonmenkaigi System Method is that it allows the participants to be reflecting on the focal issue being considered in terms of causation and impacts on human livelihoods and surrounding nature. This is especially useful in terms of analysing climate change engagement, as it is not just the human livelihood that the issue is having negative impact upon, but also pernicious impacts on natural world at a local, national and international scale.

6.3.2. Results from the Yonmenkaigi System Method

The following sections demonstrate some of results of the Yonmenkaigi System Method, including the themes and ideas in which the students engaged with to help reduce the impact of climate change within Newcastle, but also based on their perception of climate change.

6.3.2.1. Yonmenkaigi Chart

Overall, 32 actions were brought up by the students for which a council, such as Newcastle, needed to be doing something in terms of combatting climate change[48]. The breakdown of the number of actions for each category depending on different timeframes can observed within Table 6.7, with more

[48] - The process of the Yonmenkaigi System Method in creating this Yonmenkaigi chart is explored in Section 4.7.

detailed analysis in Table 6.8. It is demonstrated that most of actions are likely to occur within the first two years.

Table 6.7 – The number of cards within the Yonmenkaigi Chart for each role

Timeframe → **Roles↓**	**Within 6 Months**	**Within 2 Years**	**Within 5 Years**	**After 5 Years**
Resources and Logistics	3	1	2	1
Communication and Engagement	3	4	3	2
Mitigation	1	2	1	2
Research and Data	5	1	1	0

Source: Author

Table 6.7 demonstrates that the majority of ideas thought up by the students concerned how best to adapt Newcastle and its citizens to the effects of climate change. However, what it also highlighted is that the students felt that climate change is a multi-organisation issue, involving firefighters; local authorities; national government; National Health Service (NHS); police; and universities. When comparing this student interaction with what is being taught in schools, it demonstrates that the students are taking a further step on from the science of climate change, which is predominantly being taught, and are starting to think and talk about the human interactions involved in adapting to and mitigating the effects of climate change.

Table 6.8 also demonstrates that the students recognise that the changes that are required for climate change are not going to occur in the short-term and that organisations and society need to think about the more medium- and long-term scenarios of both mitigation against and adaptation to climate change.

Table 6.8 – The Yonmenkaigi Chart after debating appropriate activities

	Within 6 Months	**Within 2 Years**	**Within 5 Years**	**After 5 Years**
Resources and Logistics	• More training for police in disaster response • More Equipment for Services (Police, Firefighters etc.) • Budgets for local councils to address green issues	• Emergency Food Supplies	• More pedestrianised areas in city for better air quality around densely populated areas • Prepare safe zones	• No fossil fuels on public transport
Communication and Engagement	• Increase public / local awareness • Extreme Weather Information e.g. snow storms and heatwaves • Inform/protect elderly community (most at risk)	• Government Involvement • Online Resources • Knowledge based on prediction from data • Local Authorities - Preparedness	• Preparation e.g. Disaster Plans • New layout proposals to prevent damage from floods • Make public health system aware of future changes	• Full national awareness and preparation plans for worst case • Secure/suggest funding for NHS

Table 6.8 – The Yonmenkaigi Chart after debating appropriate activities (Continued)

	Within 6 Months	**Within 2 Years**	**Within 5 Years**	**After 5 Years**
Mitigation	• Penalise non-green behaviours / incentives for green behaviours such as cheaper parking for electric cars	• Train people in disaster recovery in preparation for a disaster/extreme weather event • Ban vehicles from certain area, congestion charging	• General legislation against climate change, such as taxations on business in terms of emissions	• Flood / sea level barriers along the River Tyne and surround bodies of water • Pass laws on poor behaviour/ environmental issues. e.g. banning plastics straws
Research and Data	• Question people on their knowledge of climate change -> NHS, police and public etc. • Checking & testing air/land and water quality • Questionnaire's for local population to see what they want & need • Research on other past successful schemes • Flora + Fauna	• Begin education people on effects of climate change	• Check monthly climate for 2-5 years to act on	

Source: Author

6.3.2.2. Perceived Worriedness of Different Issues

The first question within the questionnaire attached to the Yonmenkaigi Exercise asked the participant how worried they were about a series of perceived issues. They were given a list of ten perceived issues and were asked to rate their worry out of "Not at all Worried", "Not Very Worried", "Somewhat Worried", "Very Worried" and "Extremely Worried". Each of these categories was then converted into a rating, with "Not at all Worried" being rated as 1; and "Extremely Worried" being rated as 5. The results of these changes in perceived worriedness within both questionnaire 1 (before the exercise) and 2 (after) is demonstrated within Table 6.9.

Table 6.9 – Perceived worriedness of different issues before and after the Yonmenkaigi System Method

Perceived Issue	Questionnaire 1 (Before)		Questionnaire 2 (After)		Mean Diff.	t value	p value	Change in Response	
	Mean	Standard Deviation	Mean	Standard Deviation				Kurtosis[49]	Skewness
Air Pollution	3.438	0.629	3.438	0.892	0.000	0.000	1.000	3.297	-1.174
Climate Change	4.250	0.683	4.438	0.629	0.188	-1.861	0.083	1.285	1.772
Deforestation	3.875	0.885	4.063	0.854	0.188	-1.145	0.270	-0.373	-0.197
Diseases	2.813	0.655	2.750	0.683	-0.063	0.565	0.580	3.616	-0.392
Economic Instability	3.000	0.516	3.188	0.544	0.188	-1.861	0.083	1.285	1.772
Espionage	2.125	0.806	2.500	0.894	0.375	-2.087	0.054	1.699	1.731
Genetic Engineering	2.375	0.885	2.375	0.806	0.000	0.000	1.000	0.027	0.000
Migration	2.250	0.931	2.500	0.730	0.250	-1.732	0.104	-0.660	0.000
Nuclear Weapons	3.563	1.031	3.313	1.014	-0.430	1.291	0.216	0.598	-0.492
Terrorism	3.375	0.885	3.063	0.854	-0.312	1.576	0.136	0.126	-0.254

Source: Author

As demonstrated within Table 6.9, before the respondents participated within the Yonmenkaigi stated they were most worried about climate change, with an average rating of 4.25. This compares to the second most worried about issue, which was deforestation at an average worriedness rating of 3.88. This represents a worriedness difference of 0.375. This is the largest difference between any two issues that were listed. This demonstrates that the sample was already very worried about climate change, even before completing a Yonmenkaigi System exercise. However, it was found that there

[49] - Standard Error of Kurtosis is 0.564

was an average increase of worry about climate change of 0.188. This increase is significant at the 90 per cent, but not at either the 95 or 99 per cent. It should also be noted that there were changes that were also observed to be significant at the 90 per cent significance, such as economic instability and espionage. The most likely reason why espionage had the largest change, and the most significant p-value, is that most students did not know what espionage was when they filled out the first questionnaire.

It is also noted that the standard deviation for climate change is slightly reduced from 0.683 to 0.629. This demonstrates that the students were becoming more homogeneous in worriedness about climate change.

6.3.2.3. Perception Change on Differing Themes

Table 6.10 demonstrates changes that the students experienced in their thinking on four differing themes. Within the third question the students were asked to rank their own personal responsibility on a Likert scale from 1, meaning "not at all", and 10, meaning "a great deal". For the fourth and fifth questions, the students were asked how bad or good that they think that impacts of climate change will have on people globally and within the United Kingdom, respectively. This was again done on a Likert scale from 1, meaning "Very Good", to 10, meaning "Very Bad". The final question, asked the students "how likely are you to take personal action to fight climate change in the next six months?" This used a Likert scale with 1 meaning "unlikely" to 10 meaning "very likely".

Table 6.10 – Perception change on differing themes before and after the Yonmenkaigi System Method

	Questionnaire 1 (Before)		**Questionnaire 2 (After)**		**Mean Diff.**	**p-value**
	Mean	**Standard Deviation**	**Mean**	**Standard Deviation**		
Personal Responsibility	7.375	1.500	7.750	1.528	0.375	0.054
Global Impact	7.625	2.778	8.250	2.176	0.625	0.129
UK Impact	6.813	2.287	7.125	1.962	0.313	0.208
Likely to take Personal Action	8.000	1.789	8.063	1.564	0.063	0.855

Source: Author

It can be found that by participating in the exercise, the personal responsibility towards climate change of the students increased by 0.375. However, the standard deviation amongst the students has slightly increased by 0.028, which means there an increase spread in the responses that the student gave back. However, when referring to Table 6.9, it can be observed that a p-value of 0.054, when rounded up, means that there is a significant difference between the first and second questionnaire, at the 95 per cent level of significance.

Table 6.10 also demonstrates the belief amongst the students that climate change is more likely to have greater impact on people outside the United Kingdom compared to those within the United Kingdom, but the UK is still likely to experience negative impacts. Research demonstrates that the students were right to believe this, with increased emigration from coastal areas and places that already are suffering from high temperatures and water shortages being likely.

It is also observed that students increased their belief that climate change will impact people within both the United Kingdom and globally, with the greatest difference being observed for the global impact which increased 0.625 compared to 0.313 for the United Kingdom. However, it is observed that despite this large increase in perception for both questions, neither was significant. This is likely due to a few students experiencing a large change in their perceptions, whilst the majority did not change their perception in relation to these questions.

Lastly, a clear majority of the students stated that they were highly likely to undertake personal action in the next six months to help combat climate change. It is noted that there is very little difference (non-significant) before and after the Yonmenkaigi System Method. This is likely due to the already high value of 8.000 to start with, meaning little opportunity for change.

6.3.2.4. Views on Responsibility for Tackling Climate Change

In question eight of the surveys, the students were asked which of six groups should be responsible for tacking climate change. The groups that were chosen within the survey were “national government”, “local authorities”, “business and industry”, “environmental groups”, “researchers”, and “you personally”.

As demonstrated within Figure 6.8, it was found that number of students that felt they have a responsibility for tacking climate change increased from 9 to 11. This represents the equal largest response increase between the two questionnaires, the other being “researchers”. Consequently, out of these six groups, the “you personally” response was notably a greater change than responses indicating “environmental groups”.

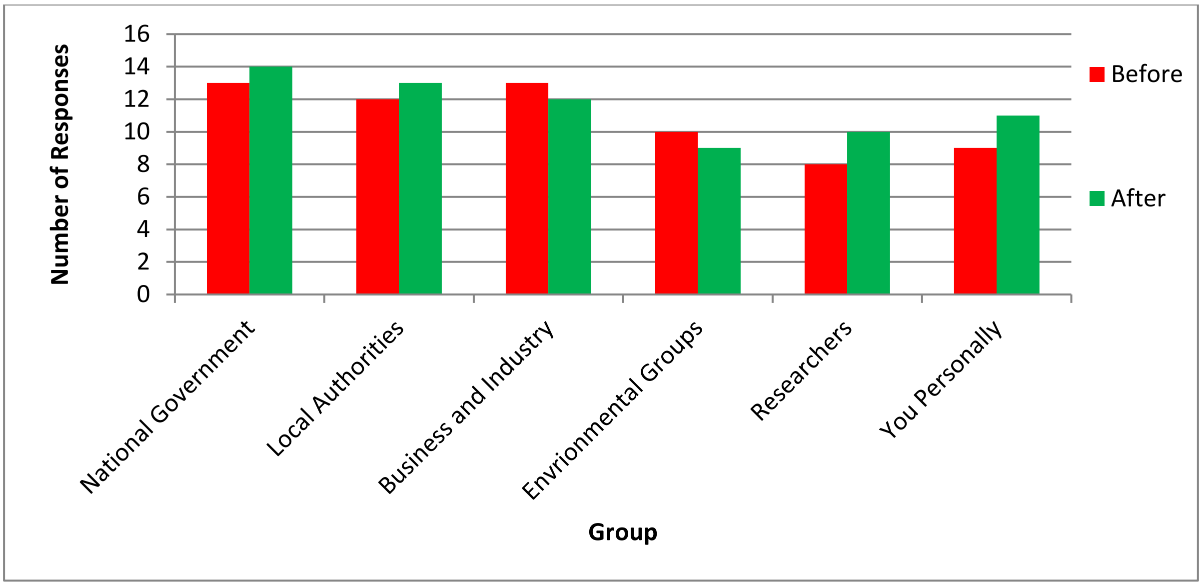


Figure 6.8 – Views of who is responsible in combatting climate change before and after the Yonmenkaigi System Method

Source: Author

6.3.3. Observation of the Yonmenkaigi System Method Process

As mentioned earlier, the students that participated within the Yonmenkaigi exercise were in their first full week of university, and consequently they knew little about each of their fellow cohort. This was felt as the best approach, as if these students that were still unknown to each other can start to communicate with each other about such an important and 'controversial' issue, it would mean that it could be possible to replicate it in the college and possible school atmosphere, where the fellow students would know each other much better; meaning that they are more likely to communicate with each other freely in a classroom setting.

It was found that the students at first were very hesitant to be open with the group about their knowledge and feeling about climate change. It could be due to the irrational fear that interviewee 2 described, when they stated that they "do not talk about climate change openly, as I am afraid of being labelled" [Male, 18-24, North West England]. This seemly is a major problem, previously talking about such a big issue that would affect their adulthood could have been viewed as 'uncool'. However, old belief systems have been challenged within the last 18 to 24 months, with the school strikes for climate change raising awareness and giving a voice for children and young people to talk about such issues without being fearful of being 'labelled' (see more about these strikes in Section 7.5 of this thesis).

As the students started to settle down to the work, they started to become more open and conversational about the issue. Consequently, there were more ideas about the topic and how best to approach climate change in Newcastle, and it was observed that all students were participating. This demonstrates that the think-square-share system works in this context, as many of the students were observed to be much more relaxed, laid back, compared to initial discussions about groups and timescales at the beginning of the exercise.

Whilst the students became more engaged and conversational about climate change in the classroom, there is no guarantee that this will be case outside of the classroom. However, even if one of the students becomes more willing to speak up about climate change, it will have achieved elements of its objective to become open about their beliefs on climate change.

6.3.4. Reflection on Yonmenkaigi as a System for Engagement with Climate Change

As demonstrated within both Tables 6.8 and 6.9, participant's responses indicate some degree of change in their responses to questions about climate change pre- and post-the Yonmenkaigi System Method exercise. The data demonstrates that after the questionnaire, the students show signs that they were increasingly concerned about climate change. However, there are differing levels of significance of the change depending on the individual question. Whilst this provides some opening in terms of a viable learning and engagement methodology, the results are not being used here to fully prove through this one analytical method a change of perception, albeit this is likely to have occurred. The intention was that it would allow the students to feel that they can talk freely about climate change without the teacher 'shooting down' discussion, as in the case given by an interviewer earlier in the chapter. It also enabled students to learn how it is okay to actively talk about important social issues, such as climate change, outside of the classroom. It should be noted that since this experimental exercise ran in October 2018, with the school strike movements (see chapter seven for further discussion), it is evident that many younger people are already engaging with the issue, and that this type of exercise would serve to deepen the understanding of what strategies could be applied beyond active protest.

One of the biggest limitations of the experiment was that only two hours were allocated to complete a full Yonmenkaigi System Method during this pilot study. On reflection this was not enough time to allow a full discussion amongst the stakeholders. Going forward, a minimum of two and half to three hours would be recommended to run each time to facilitate the full approach.

Overall, the Yonmenkaigi System Method has demonstrated that relatively simple exercises, can change student's perception of climate change although more applications will need to be carried out, to extend the effect further and to see if there is true and sustainable change in perception as a result of engagement with the Yonmenkaigi System Method or other similar approaches.

One of the potential drawbacks on trying to implement this within the British education system is that currently most classes will have between 28 and 32 students, which is too big for an effective Yonmenkaigi System Method to be undertaken. The solution would be the use of two sets of teachers and breaking the size of class down; given the scale of the issue being addressed this additional investment would seem appropriate.

6.3.5. Yonmenkaigi System Method and the Pedagogical Action Research

It has become increasingly recognised throughout this thesis that the British educational curriculum is quite restrictive in its nature. It is therefore important to explore different ways in which climate change can be taught at different age group levels and in a way that is inclusive to all students. Therefore, the partial purpose of Yonmenkaigi System Method in this thesis is also to explore how students both react and engage to this method of education, in relation to pedagogical action research.

Pedagogical action research is defined by Norton (2018, p.1) as a "type of research that aims to improve teaching and learning practice in the higher education sector". However, it is arguable that these practises for the higher education sector can trickle down to secondary education. One way of looking at pedagogical action research is to look at what Waring an Evans (2015) highlight as full approaches to pedagogical action research, as demonstrated in Figure 6.9. This viewpoint has four different approaches in exploring if the approach is truly successful.

The case of the Yonmenkaigi System Method application to views of climate change allows for students to openly express their faults on the subject based on a narrative cognition that they have built through personal experiences of climate change, or via interactive engagement through either conversations or consumption of the media. Since the focus of the Yonmenkaigi System Method is about building resilience against climate change at the local level (in their own community), it means that students will be able to build a narrative around personal experiences, extending even to personal experience of being directly impacted by a major event or having witnessed the disruption and damaged these events calls.

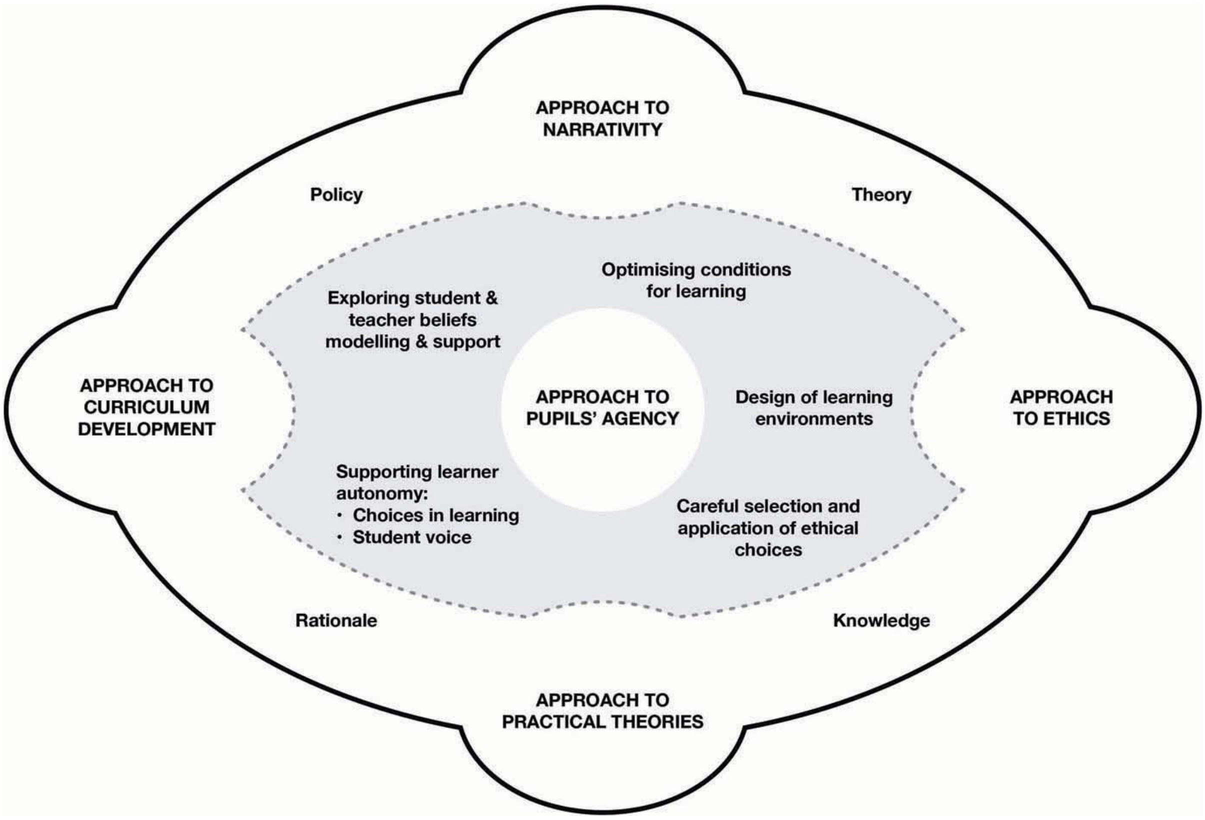


Figure 6.9 – The four approaches to pedagogical action research (Waring and Evans, 2015, p.28)

In terms of curriculum development, it is arguable that the usage of the Yonmenkaigi System Method provides multiple aspects of life skills that the students are going to need in the outside world, not just knowledge of climate change. The method means that students have to adopt a more critical analysis to a given problem, instead of being told of solutions to the problem which is common in secondary education. This leads to another important life skill being developed, based on the importance of being able to debate with your peers and acceptance that individuals will disagree on how to best approach a problem.

In terms of ethics, it is arguable that the usage of Yonmenkaigi System Method actually means that all opinions can be discussed and debated instead of a narrative being developed by a teacher; in this case that was highlighted by interviewee number one earlier in this chapter. This means that students understand that not everyone fully agrees with the accepted scientific consensus and will be less likely to question why certain information wasn't portrayed to them whilst growing up and learning at school about the issue. However, a potential ethical issue in using the Yonmenkaigi System Method is that having students discuss the impacts they have personally had experienced due to climate change and extreme weather events might bring on psychological issues, as research previously has disclosed that children significantly impacted by extreme weather events have been impacted by post-traumatic stress disorder [PTSD] and anxiety in general (Cruz *et al.*, 2020). Naturally, this psychological trauma is not uniquely limited to just extreme weather events but to all types of disasters including those of COVID-19.

Lastly in terms of approaches to theories, this method could allow for other such issues to be taught and discussed which does not need to be exclusively via the Yonmenkaigi System Method approach but could take elements of the approach. For example, issues surrounding religious beliefs could utilise the debating elements of this method. But the use of the approach adds more confidence into this process.

6.4. Public Workshops

As highlighted in Section 3.4, climate change only came into the national curriculum in 1995. This can be demonstrated by 37.1 per cent of the respondents to the first survey of this thesis having not had any formal education on the issue. This means that a large proportion of the population have not had any education on climate change and appear to be relying on the media and reading of the internet to gather information about climate change. The next section of this chapter addresses the number of people that are engaging with social media to find information about climate change. The current section first considers people who are learning from experts in the climate change field via the medium of public workshops. As demonstrated in the last section, workshop activities can give people the unique opportunities to give their points of view about climate change, which hopefully will allow the individuals to understand that there is more than one way to deal with climate change. However, it also allows the public to learn and personally speak with individuals that are studying within the climate field. A similar process has been undertaken during the Climate Assembly, which is outlined within Section 7.6, of this thesis. However, one respondent of the Climate Assembly stated that "I knew very little about climate change when starting this journey … I have learnt so much about climate change [with the climate assembly], I realise the importance of making changes to our lives" (UK Parliament, 2020). This quote demonstrates that public workshops about climate change with academics and other members of the public is a good way facilitating learning amongst the public about climate change, and a way of potentially breaking down existing barriers between the scientific community and civil society through post-normal science. This theme is explored further in Section 7.2.

Despite there being proven benefits of public workshops, as referred to within the previous section and as consolidated later in this thesis, there are debates about their use going forward. Firstly, who are going to be fund them, and secondary do the public want these. The respondents within the first survey [March to September 2017] were asked "Do you think that workshops and presentations should be offered freely to the public to explain the science and effects of climate change?".

It was found that most of the respondents [79.5 per cent] agreed that workshops should be offered freely to the public about climate change. However, Table 6.11 demonstrates that the levels of support for these workshops vary between the differing age groups and the genders. In general, the proportions that are supportive declines from 90.2 per cent for the 18-24 age group to 74.8 per cent for the 65+ age group. The one notable exception is the 35-44 age group, which has the same level of support as the 65+ age group. However, there is no significant difference between the age groups '35-44' and '45-54' ($\chi2=0.446$, $p=0.504$), meaning that it is possible that these differences could have occurred by chance.

In terms of gender, it is found that females are 9.9 per cent more likely to believe that workshops about climate change should be freely offered to the public compared to their male counterparts, with this difference been significant ($\chi2=16.126$, $p=0.000$***).

Table 6.11 – The proportion of respondents who think workshops about climate change should be freely offered to the public

	Yes	No	Don't Know	Refused
Overall	901 (79.5%)	111 (9.8%)	118 (10.4%)	4 (0.4%)
18-24	147 (90.2%)	7 (4.3%)	9 (5.5%)	0 (0.0%)
25-34	128 (84.8%)	10 (6.6%)	12 (7.9%)	1 (0.7%)
35-44	86 (74.8%)	15 (13.0%)	14 (12.2%)	0 (0.0%)
45-54	132 (78.6%)	17 (10.1%)	17 (10.1%)	2 (1.2%)
55-64	178 (77.4%)	27 (11.7%)	24 (10.4%)	1 (0.4%)
65+	226 (74.8%)	35 (11.6%)	41 (13.6%)	0 (0.0%)
Male	512 (75.6%)	82 (12.1%)	80 (11.8%)	3 (0.4%)
Female	383 (85.5%)	28 (6.3%)	36 (8.0%)	1 (0.2%)
High Trust of SR	752 (85.7%)	40 (4.6%)	83 (9.5%)	2 (0.2%)
Low Trust of SR	63 (45.7%)	58 (42.0%)	15 (10.9%)	2 (1.4%)

Data Collection: March – September 2017; SR = Scientists and Researchers

Source: Author

Overall, it demonstrates that the public are accepting of workshops and potentially demonstrates that there is an underlining willingness of the public to further understand climate change, partially from scientists and researchers working in this field, as the level of trust as demonstrated in Section 5.10 is still high. This is further demonstrated within Table 6.11 when exploring the levels of support for workshops amongst those with a high trust of scientists and researchers, which is 40.0 per cent higher than those with low trust of scientists, which is a very significant difference ($\chi2=121.152$, $p=0.000$***).

With the lack of free workshops, as highlighted within Section 3.4, the public will use the media to explore information about climate change.

6.5. Social Media

Within recent years, there has been a wholesale rise in the number of people using social media. For some people, this type of media has taken over from the conventional news. Whilst it helps spread more information about climate change wider than conventional news, it also produces fundamental problems of "fake news" and "echo chambers", as demonstrated within Section 3.5 of this thesis. This can lead to polarisation of public views on climate change and the spread of false information that might lead to increased levels of mistrust towards certain groups of scientists or politicians. It should be noted that this issue does not contain itself to just climate change, but towards all scientific and political issues. This has recently been seen during the COVID-19 pandemic, which has led to misinformation being spread across various social media sites (Frenkel, Alba and Zhong, 2020; Pennycook *et al.,* 2020; Russonello, 2020; Weismueller *et al.,* 2020). Consequently, it is important to gauge the proportional impact of a potential increased exposure to climate sceptic narratives.

Within the first questionnaire between March and September 2017, the respondents were asked; "do you gather information about climate change from social media sites?". Table 6.12 demonstrates the overall response as the proportion of the respondents that do and do not use social media to gather information about climate change. It is found that the majority of responses [56.0 per cent] who answered the question do not gather information about climate change on the diverse range of social media platforms. There is a significant difference between those who do and those who do not use social media for climate change ($\chi 2=50.857$, $p=0.000$***).

Table 6.12 – Proportion of respondents who actively seek climate change information from social media platforms

Response	Proportion of Response with Social Media		Proportion without or declined to indicate if use Social Media
Yes – actively seek CC info	387	34.1%	39.9%
No – not actively seek CC info	544	48.0%	56.0%
Don't Know	40	3.5%	4.1%
Refused	163	14.4%	
Total	**1,134**		**971**

CC = Climate Change

Source: Author

Whilst a considerable number of the respondents use newly emerging platforms to gain information about climate change, Table 6.13 demonstrates different age group's usage. It is found that apart from the '35-44' age group, increasing age groups are less likely to use social media for climate change information and with young people [18-24] being the only age group that is over 50 per cent. This is expected as increasingly young people are turning to social media sites to consume news (Griffin, 2020).

Table 6.13 – Proportion of respondents that use social media to gather information about climate change

	18-24	25-34	35-44	45-54	55-64	65+
Yes	87 (53.4%)	63 (41.7%)	36 (31.3%)	63 (37.3%)	75 (32.6%)	61 (20.2%)
No	69 (42.3%)	70 (46.4%)	65 (56.2%)	83 (49.1%)	110 (47.8%)	144 (47.7%)
Don't Know	6 (3.7%)	8 (5.3%)	4 (3.5%)	4 (2.4%)	8 (3.5%)	10 (3.3%)
Refused	1 (0.6%)	10 (6.6%)	10 (8.7%)	18 (10.7%)	37 (16.1%)	87 (28.8%)
Total	163	151	115	169	230	302

N= 1,130; Sample Collection = March to September 2017

Source: Author

These results are not surprising confirming data from Ofcom (2018 and 2020) as demonstrated within Table 6.14. It is found that as of 2020; the majority of young people now use social media to consume news about current affairs [70.8 per cent], and this has increased 0.8 per cent between 2018 and 2020. Table 6.13 also demonstrate that for a sizeable proportion of the young people, use social media replaces instead of being an addition to more traditional news [such as television, radio and printed newspapers]. It clearly implied that if the scientific community want to engage young people with climate change and educate them with the facts and current events of climate change, then a focus on social media is needed. Whilst, as highlighted within Section 3.5.3 of this thesis and earlier in this section, social media can fuel scepticism and confusion about climate change amongst civil society, social media also gives scientists and academics that research climate change a platform to share research and discuss climate change with the public. By contrast, the wider community would otherwise have to rely on traditional media to mostly convey this work.

It is worth noting that it is not just young people that are using social media, overall, 45.7 per cent of the respondents are now using social media to gain information, which represents a 1.8 per cent increase between 2018 and 2020, this increase over even this short timespan being significant at the 90 per cent level.

Table 6.14 also highlights a trend that more people [2.2 per cent increase between 2018 and 2020] are not using any of the listed methods to gather information about news and current affairs; with the most been amongst the youngest [7.6 per cent]. This raises the question as to from where these respondents are gathering their information about current affairs and whether these individuals are up to date on the latest information about climate change that will affect them.

Table 6.14 – Where do the public gather information about news and current affairs from in 2020 and comparisons with 2018

	16-24	25-34	35-44	45-54	55-64	65+	Overall
Television	53.3% (-6.1%) **	63.5% (-7.5%) ***	72.9% (-4.0%) *	82.6% (-5.4%) ***	87.3% (-0.8%)	91.2% (-3.4%) ***	75.5% (-5.3%) ***
Radio	26.4% (-1.4%)	39.3% (+1.3%)	44.9% (-0.2%)	48.0% (-4.7%) *	51.7% (-1.3%)	48.1% (-3.6%)	43.2% (-2.2%) **
Social Media on a Computer / laptop / netbook / tablet	38.4% (-5.3%) **	40.0% (-6.4%) **	31.5% (-2.6%)	28.3% (-0.6%)	24.7% (-0.6%)	13.6% (-0.7%)	29.0% (-2.2%) **
Social Media on a Mobile Phone	65.8% (+4.0%) **	56.4% (-1.8%)	45.5% (+2.0%)	32.2% (+4.4%) *	21.3% (+2.5%)	8.6% (+2.5%) **	37.6% (+3.3%) ***
Newspaper [Printed]	20.7% (-1.5%)	23.5% (-8.3%) ***	31.3% (-3.4%)	32.0% (-9.3%) ***	42.9% (-3.1%)	55.3% (-1.8%)	34.8% (-5.2%) ***
Other internet sources on a computer / laptop / netbook / tablet	25.5% (+2.3%)	26.4% (+0.7%)	26.4% (-1.1%)	25.8% (-6.1%) ***	29.8% (-2.1%)	25.1% (+3.1%)	26.4% (-0.4%)
Other internet sources on a mobile phone	32.8% (+5.5%) **	29.6% (+2.7%)	29.7% (+1.6%)	23.2% (+3.5%) *	20.8% (+2.6%)	13.6% (+6.6%) ***	24.7% (+4.2%) ***
Interactive TV	3.0% (-4.7%) ***	6.3% (-4.9%) ***	6.3% (-3.5%) ***	8.4% (-2.3%)	8.1% (-4.1%) **	8.5% (+2.1%) *	6.8% (-2.7%) ***
Magazines (Printed)	5.1% (-4.6%) ***	10.3% (-4.2%) **	9.5% (-1.2%)	8.5% (-4.2%) ***	13.0% (+1.8%)	10.6% (+0.2%)	9.5% (-2.1%) ***
Word of Mouth	40.6% (+7.5%) ***	37.3% (+4.2%) *	35.0% (+6.0%) ***	32.0% (-3.9%)	33.8% (+0.9%)	30.5% (+3.0%)	34.7% (+3.1%) ***
Podcasts[50]	12.0%	12.5%	7.0%	4.4%	4.6%	2.0%	6.9%
None of these	7.6% (+2.7%) **	7.0% (+4.9%) ***	3.6% (+1.0%)	3.3% (+1.9%) **	3.3% (+1.9%) ***	1.8% (+0.7%)	4.3% (+2.2%) ***
Social Media on any platform	70.8% (+1.2%)	64.9% (-2.9%)	53.3% (+3.4%)	42.0% (+2.5%)	31.5% (+1.2%)	16.2% (=0.0%)	45.7% (+1.8%) *

N=4,618 (2018); 4,576 (2020); * = 90 per cent significance; ** = 95 per cent significance; * = 99 per cent significance.**

Source: Data reworked from Ofcom (2018) and Ofcom (2020)

[50] - Percentage change is not possible for 'podcasts' as it is new category for 2020 survey

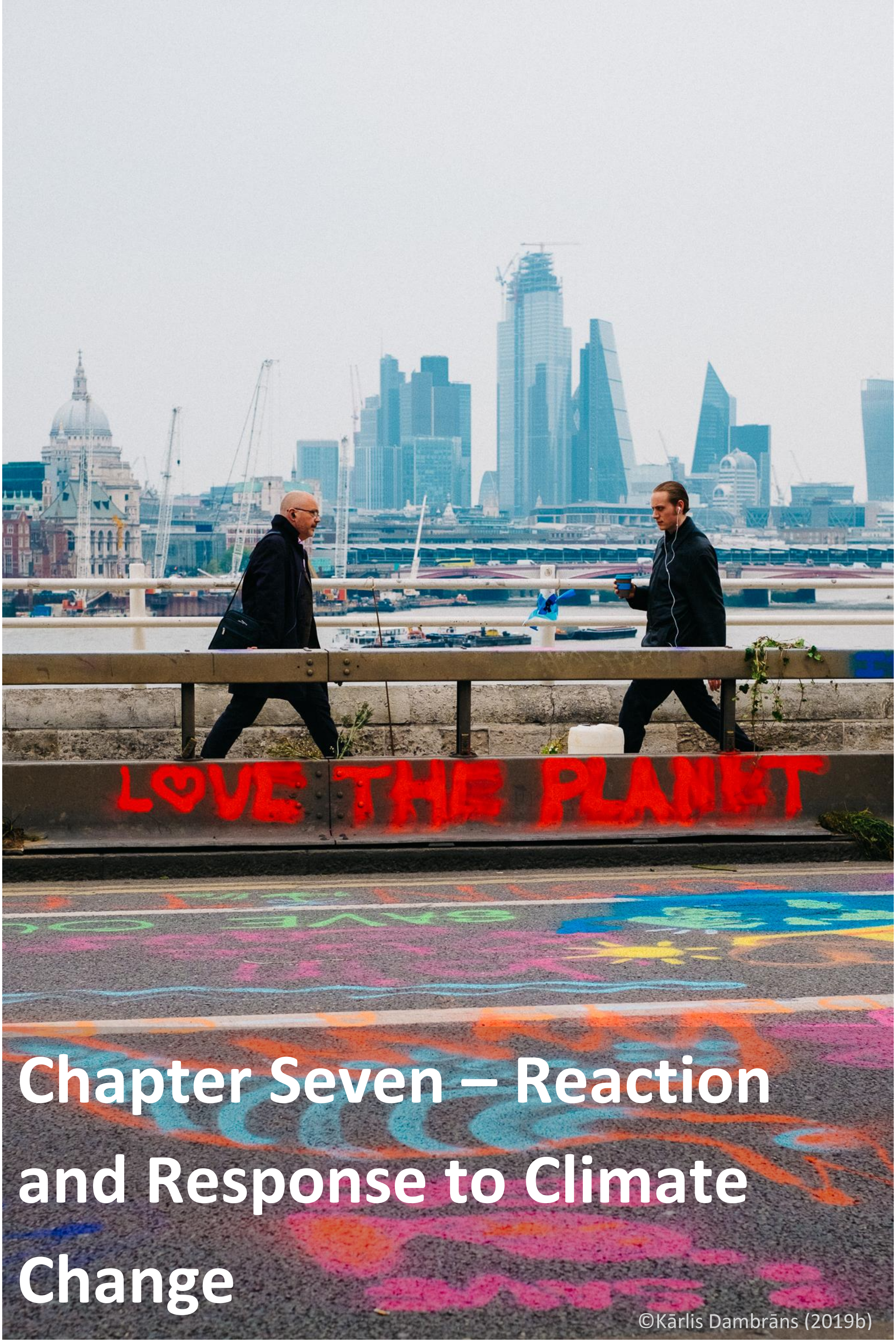
6.6. Summary

This chapter has demonstrated that civil society within the United Kingdom can engage with climate change via numerous different means; these include with different mitigation strategies. It has been found that financial capability to be able to apply some of the critical mitigation strategies is the barrier, and these are strategies that would reduce the greenhouse gas emission levels. Financial barriers are particularly prevalent within the youngest in civil society, despite this part of society being those who overall want to do more to reduce their and other's greenhouse gas emissions. The research has found that the majority of the public believe that the government are responsible for combatting climate change, which would explain why they have been the main focus of Extinction Rebellion's and other campaign attention, increasingly over the last 18 months.

In terms of education, climate change exists within the national curriculum in secondary schools and colleges and is referred to by a range of other outlets that can be accessed by the public. However, with the academicization of the education sector within the United Kingdom, schools, especially at Key Stage 3, are being left to teach what they feel like. In general, most people engaging with the research believe that education about climate change in the formal education sector needs to increase, with most believing that it should be more focussed in primary and secondary schools.

One way of potentially improving the education of climate change is through a more participatory form of education around critical issues, such as demonstrated by the application of the Yonmenkaigi System Method. It has been found that even in quite brief encounters of participants in the UK, and as suggested by its application for other risk related issues elsewhere, this can improve the perception of climate change amongst the students that took part in the experiment. It was found that students were actively engaging the exercise, rather than simply being taught climate change.

Entire sections of society, particularly older groups, have had no formal education on climate change; the science of climate change is relatively new and constantly updating, such that what the public were taught at school [if taught, depending on their age] is likely to be outdated. Consequently, they are reliant on the media, and increasingly social media, to gather information about climate. One possible way of updating the understanding of climate change amongst the public is through workshops, and it was found that the majority of those responding to this research would prefer this. However, until the Climate Assembly, held in January-March 2020, there were no regular or national climate change workshops for the general public. This demonstrates a real divide between climate science and its advocates and civil society more widely.



Chapter Seven – Reaction and Response to Climate Change

©Kārlis Dambrāns (2019b)

"My friends, love is better than anger. Hope is better than fear. Optimism is better than despair. So let us be loving, hopeful and optimistic. And we'll change the world."

Jack Layton (2011)

Leader of the Canadian Opposition

7.1. Introduction

As the previous two chapters have demonstrated, the overall level of perception about climate change within the United Kingdom is that it is happening and is a serious issue. However, there is uncertainty about the nature of current and future impacts it will have on the United Kingdom. Chapter Six showed that there are varied ways in which the public are already engaging with climate change concerns; also demonstrating that behavioural changes are likely with shifting perception. However, the inter-communication between the scientific community, politicians and civil society remains weak.

This demonstrates the need for partnership between the differing stakeholders in finding the best way forward in both mitigating against and adapting to climate change, whereby science advises government on more complex and uncertain issues. Kaiser (2019, Online) highlights four major challenges in building a framework for science to advice governments. These are the following:

1. *The holistic challenge:*
    a. *Complex issues call for radical interdisciplinarity.*

2. *The pragmatic challenge:*
    a. *There is no easy balance between the wants of the recipient and the scientific advice given with integrity.*

3. *The post-normal challenge:*
    a. *Integrate uncertainties, values and alternative knowledge sources.*
    b. *Provide knowledge quality assessments.*

4. *The trust challenge:*
    a. *Threats not only from the outside, but significantly also from science: a crisis.*
    b. *Good knowledge requires context and historical reflection*

These issues have become a major challenge in trying to achieve progression in combatting climate change through mitigation. The following four sub-sections critiques and expands each of these challenges in exploring their interlinkage with climate change reaction and responses.

7.1.1. The Holistic Challenge

Climate change is known to be a complex challenge as the climate system itself is highly complex. It could also be described as a 'wicked problem' as it is a problem that has a unique set of characteristics that make them problematic to tackle (Rittel and Webber, 1973) [see Rittel and Webber, 1973 for more in depth describe of the main characteristics of 'wicked problems']. However, the issue around engagement goes beyond this statement. To fully understand on how best deal with complex issues, such as climate change, research communities need a truly interdisciplinary approach. Climate change research is associated with physical scientists who quantify climate changes. But, to truly fix the issue, climate change research and communication needs to go beyond that. It could go as far as saying that you can do all the climate research you want, but if you do not know how to communicate your findings to the public (informed in particular by psychology and sociology) and can figure out the best practice and policy approaches to solving the issue, the accumulated science generated is of little real use. However, the science is of use, as it provides researchers and the public the chance to look at the past climate and consider the implications for the future. The argument is that physical and social sciences need to work together more closely to tackle climate change with governments and all stakeholders. This argument for a more interdisciplinary research environment has been discussed for many years (Heberlein, 1988; Lu, 2016). It was also demonstrated earlier in Chapter Five, in showing that the perception of climate change is homogenous within the borders of a sovereign nation, meaning that scientists are going to need to communicate the science and potential ways forward in and integrated and different way.

Currently, research confirms a funding gap between physical and social sciences. Overland and Sovacool (2020) show that between 1990 and 2018, the physical sciences work on climate change received 770 per cent more funding compared to the social sciences. This demonstrates a significant imbalance in funding between the two types of scholarly activity with consequent deficits in relation to dealing with the all-important reaction and response aspects of climate change research.

It is arguable that the IPCC are however tacking the interdisciplinary issue to some extent. This is demonstrated within the next round of IPCC reports that are due in early 2022. There are set to be three working groups called 'The Physical Science Basis', 'Impacts, Adaptation, and Vulnerability', and

‘Mitigation of Climate Change’ (IPCC, No Date b) and as already reflected in some of the earlier reports from that source. These however appear to lack the requisite reactions and responses implied.

7.1.2. The Pragmatic Challenge

There is no magic bullet when combatting climate change. Contemporary infrastructure has been designed in such a way that is not sustainable in limiting the effects of climate change and adapting toward project climate change. This is the case for example whether building homes on floodplains (Rowlatt, 2019; Halliday and O’Carroll, 2020) or in the usage of fossil fuels in the energy sector. Projections are that to limit temperature increases to the 1.5°C target, set within the Paris Agreement in 2015, would mean that every country in the world will need to achieve net zero carbon dioxide levels by 2050 (Allen *et al.,* 2018). This is despite, as shown in Section 5.11.1, only 35.5 per cent of the respondents in the research for this thesis having any awareness of this term.

Currently, only a few countries and territories have set some form of targets to be net zero by 2050, including Ireland and the United Kingdom. However, those who are emitting the most have not set similar targets, with the highest polluter, China, planning to continue raising emissions for at least another ten years (den Elzen *et al.*, 2016). It has become an increasingly difficult issue for the United Kingdom to get some to engage with climate change, when other countries are still carrying on polluting large quantities of greenhouse gas emissions. A typical response indicated here by respondents OLC067, states that the United Kingdom is “only a very small country and cannot affect a lot in the world. Until China agrees to combat pollution what the UK does is immaterial” [Male, 45-54, East Midlands]. Respondent OLC012 stated that the “UK [reduction in emissions] is meaningless; [the] USA, China, and India are vital if we are to achieve any change” [Male, 65+, North West England]. This backs up with what has been observed within Section 6.1, which demonstrates that 26.3 per cent of the respondents who stated that it is not worth doing things to help reduce climate change if others do not do the same. Consequently, it is not surprising that some of the respondents also have a feeling that the United Kingdom government should be either “encouraging large countries” [Male, 45-54, Wales] or “putting pressure on China & India” [OLC157, Female, 65+, East Midlands] to do more.

Despite of all of this, over the years, the United Kingdom has deployed a number of techniques in the form of policies and statutory instruments to reduce greenhouse gas emissions of both business and of individuals through either changing behaviour or developing more efficient technologies. One which has been frequently been cited within this thesis is fuel duty, which has been shown to be a way to reduce emissions from vehicles. It was noted in Section 5.11.2 that 42.8 per cent of the respondents in 2017 were supportive of an increase in fuel duty. However, the issue is that it could result in strikes, protests, disobedience and maybe even riots. Elements of these have been seen previously in both the United Kingdom [Autumn 2000] and internationally [France 2018].

This has demonstrated that the United Kingdom has great difficulty in balancing guidance of the scientific community with the practicalities of action. Whichever government is in charge, climate change is likely to be a scientific and political hot potato. Consequently, a view expressed is that civil society should be "demand[ing] government action to address causes" [OLD172, Male, 55-64, Scotland].

Beyond climate change, other recent scientifically informed threats face similar issues, such as regarding the advice of the scientific community for COVID-19. In this case, if the government followed the advice of the scientific community fully, it is likely that lockdowns would last for longer and probably damage the economy further, drawing large criticism due to unemployment. However, if the government listens to economists, then the country is likely to have entered a partial lockdown or no lockdown, which would have spared the economy extreme unemployment figures, but would result in many more deaths and would draw criticism for allowing people to die. A group of researchers in the immediate outbreak of COVID-19 within the United Kingdom argued that this is a clear example of post-normal science. In many ways, COVID-19 has very many similar traits to the post-normal climate change science dilemma.

7.1.3. The Trust Challenge

When trying to get anybody to do something, first they need to have trust in what is been said to them. A similar scenario is needed for climate change. If the public do not trust either the scientists and/or politicians about the messages on climate change, then the likelihood is that the public will not undertake any engagement strategies to either mitigate against or adapt to climate change. Therefore, both elements [scientists and politicans] need to build rapport with the civil society such as regards fuel duty. The right ideas were brought forward, but with little public communication about the reasoning behind the measure. The speed in which fuel duty was rising, meant that it became deeply unpopular amongst the public, as demonstrated with a survey at the beginning of the protest highlighting that 78 per cent supported a fuel blockage (BBC, 2000b).

As highlighted in Chapter 5.10, the overall trust amongst groups of scientists in relation to climate change has remained high, with this group ranking first overall for trust in the climate messages [with a score of 4.08 out of 5], despite disruptive stories [as highlighted within Table 5.3] and a general push back by climate sceptics over the years.

Kaiser (2019) highlights that the scientific community needs to be careful of trust threats from within the scientific community itself, especially researchers that are sceptical of the scientific consensus of climate change, such as Lennart Bengtsson, Don Easterbrook, Wibjörn Karlén, Roger A. Pielke Jr. and Fred Singer. As highlighted earlier, scientific scepticism can be productive, as it helps refine science to make the research more thorough. However, when this scepticism is aired with the public via the medium of media that can distort, it can lead to reactions based on believing that the science is not settled.

7.2. Post-Normal Science

As highlighted earlier within the work by Kaiser (2019), there are four main challenges in creating a potential framework for science to advise government. The fourth of these, 'the post-normal challenge', is also an outcome of this thesis.

The concept of 'Post-Normal Science' was developed by Funtowicz and Ravetz (1993) but has its origins in the mid-1980s (Petersen *et al.*, 2011). Post-normal science is when scientific issues have high system uncertainty and/or the decision stakes are also high, as demonstrated within Figure 7.1, but also when the decision for action is needed urgently (Funtowicz and Ravetz, 1993). The concept of 'Post-Normal Science' is a spin-off from the concept by Kuhn (1962) known as 'Normal Science'. Kuhn (1962, p. 10) stated that normal science is the 'research [which is] firmly based upon one or more past scientific achievements, achievements that some particular scientific community acknowledges for a time as supplying the foundation for its further practice". This approach is based upon science as a process, which is debated about via the differing rules of science (Turnpenny, Jones and Lorenzoni, 2011). Throughout this process of debating, some scientific knowledge can periodically undergo a shift in paradigm. However, when this paradigm cannot be accepted, then it can lead to revolutionary science, in which the rules of science are examined and changed for a new set of paradigms (Kuhn, 1962). However, this work especially around revolutionary science was criticised by Ravertz (1986, p. 419), who states that the concept of asseverating science in practice was "an essentially myopic and anti-critical activity". They go on further by giving a list of examples which at the time could be viewed as complex scientific issues, such as acid rain, toxic waste and greenhouse gases. Ravertz (1971) believed that part of the issue was that science had become increasingly industrialised, with a sole focus on report writing for the purpose of attaining funding for future projects and personal promotion. This led science to be become too focused on one issue and scientists were unable to see the bigger picture (Ravertz, 1986). It led to questions as to whether government were becoming too reliant on science (Turnpenny, Jones and Lorenzoni, 2011). As highlighted by Turnpenny, Jones and

Lorenzoni (2011) the science started to develop in the mid-1980s, when more complex scientific matters started to come to the forefront in terms of when the issue was complex in nature, had degrees of uncertainty, but the potential harm to both humanity and local/global ecosystems were high, especially if they were not addressed with some urgency. Ravertz (1986, p. 422) highlights that under the old 'normal science' approach, it was woefully insufficient to deal with these issues where "facts are uncertain, values in dispute, stakes high and decisions urgent". Consequently, Funtowicz and Ravetz (1991) created the concept of Second Order Science, which would be called 'Post-Normal Science'. They stated that the new approach to science should be "developed [upon] to make our ignorance usable" (Funtowicz and Ravetz, 1991, p. 141). Forrester, Gerger Swartling and Lonsdale (2008) highlight the difference between the approaches being three fractions of post-normal science, as demonstrated in Figure 7.1.

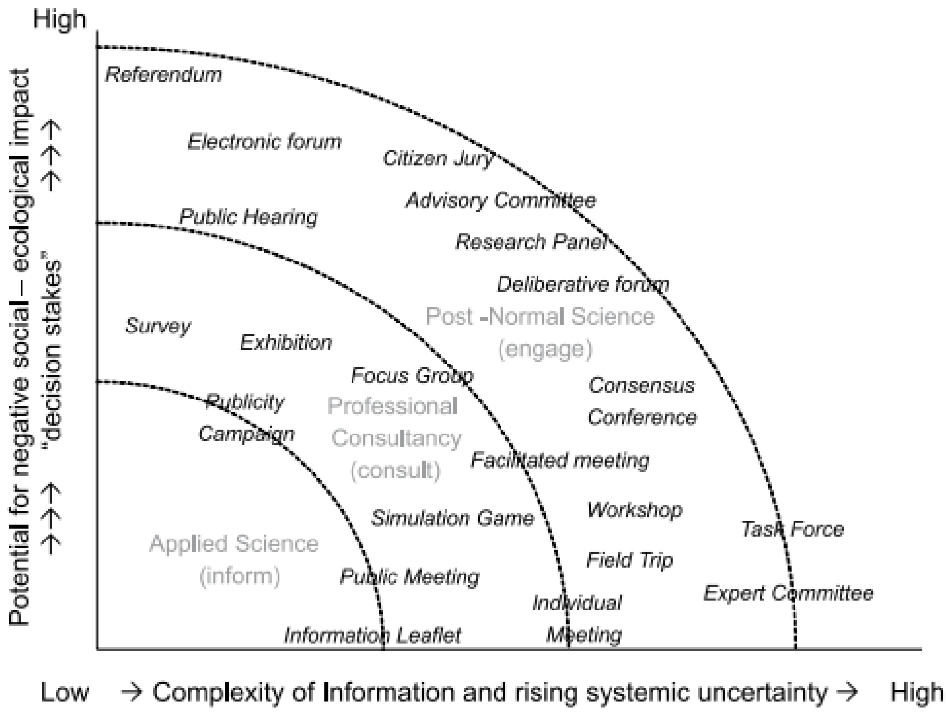


Figure 7.1 – Post-Normal Science Diagram (Forrester, Gerger Swartling and Lonsale, 2008, p.11)

The first is the 'applied science' element, which is purely about informing civil society and politicians about the issue. This could be undertaken in different ways, but a perfect example given for this would be the IPCC reports. The second step is the 'professional consultancy' this is when the scientific community goes out to seek the opinions of the public about set issue. This could be undertaken in varied ways, such as for example, through surveys, focus groups, public gatherings, and simulation games. It is arguable that this thesis asking public/respondents about their perception of and engagement with the issue of climate change is an example of this approach. The final step is the actual ‘post-normal science’ where engagement with the issue is usually between the scientists, the politician and civil society. This is achieved in numerous ways, such as workshops, citizen jury, expert committee, public hearings, and even referendums. It is arguable that the usage of post-normal science within the climate change sector could help as a way of building trust amongst civil society and breaking down the invisible barriers that have seemingly existed between the academic community and civil society on this issue. This problem was discussed in a documentary on BBC Radio 4 released in August 2020 called ‘How They Made Us Doubt Everything’. Within this radio documentary, the issue surrounding the lexicon that scientists are using, can be very confusing to the general public and has been used in the past and even today by climate sceptics to confuse and mislead the public (How They Made Us Doubt Everything, 2020). Susan Hassol [Director of Climate Communication] who highlights the terms ‘uncertainty’ as a perfect example of how the lexicon being used by the climate and scientific community, can be confusing for civil society to understand and lead to mistrust and scepticism. In the documentary, Susan states that “to the public, [the term] ‘uncertainty’ means we just don’t know … [whereas] … the scientists use ‘uncertainty’ to talk about a range around the particular measurements or projections” (How They Made Us Doubt Everything, 2020, 13:45). This is not the only term that has a different meaning depending on the user, with Table 7.1 giving further examples of different meanings between scientists and the public.

Table 7.1 – Example of terms that have different meaning for scientists and civil society

Scientific Term	Public Meaning
Enhance	Improve
Aerosol	Spray can
Theory	Hunch, speculation
Uncertainty	Ignorance
Error	Mistake, wrong, incorrect
Bias	Distortion, political motive
Manipulation	Illicit tampering

Adapted from Somerville and Hassol, 2011, p.51.

So far, this chapter has in detail discussed post-normal science and the issues of potential frameworks in which scientists and politicians can communicate to achieve the best possible result in responding to complex issues, such as climate change. But this does not resolve what happens when post-normal science does not exist in practise. Pre-2019, the United Kingdom had seemly lacked the capacity to allow the general public to get involved in having a say on climate change and what they think could be undertaken at a local and national level to combat climate change. This has the hallmarks of what this thesis is concluding is ‘post-normal engagement’. This is similar to ‘post-normal science’ in many respects but is when the public are forcefully going out to make their voices heard through the medium of activism. It is therefore arguable that the definition of ‘post-normal engagement’ in the context of climate change is when the civil society feel that at an individual level, they are doing their bit to mitigate against and adapt to climate change but feel that a lack of credible action is being taken at government level to back up what they are doing. It includes being able to have a say in the future action about climate change, and when not, they embark on a form of activism, whether it is through protest or civil disobedience. Figure 7.2 demonstrates this ‘post-normal engagement’, in the outer zone of Forrester et. al’s concentric arcs, the boundary to it being a barrier requiring transitioning in the United Kingdom and elsewhere; the push from the inner circles is via a push from the public through activism and civil discordance to make their voice heard and force the government to change.

The following sections explore the year 2019, when post-normal engagement with climate change issues took off within the United Kingdom. It explores two main groups of activists that were demonstrating during this period, and the overall perception of these groups and types of activism that they undertook. It should be noted that the monitoring of the demographic composition of climate protests has helped here to assess the nature of likely reactions and resistance to the content of COP26 being hosted in Glasgow, Scotland in November 2021.

7.3. Background to the 2019 Climate Activism

The year 2019 has seen climate change increasingly in the public discourse, as demonstrated by a 124.8 per cent increase in the number of climate change articles within newspapers within the first six months of 2019 compared to the same period of 2018 (Boykoff *et al.*, 2020). This increase in attention is due to varied reasons.

Firstly, in terms of meteorology, the United Kingdom broke two temperature records within 2019. The first was on the 26th February, when the United Kingdom experienced its warmest winter day on record, with temperature being recorded at 21.2°C in Kew Gardens, London (BBC News, 2019d). The other record occurred on the 25th July, when the United Kingdom experienced its warmest day on record, with temperature recorded at the Cambridge Botanic Garden at 38.7°C, which beat the previous record by 0.2°C (Met Office, 2019). In addition to this, the United Kingdom experienced its equal warmest summer in 2018 (Met Office, 2018).

In terms of political responses, the United Kingdom became the first country to declare a climate emergency on the 1st May; with both regional governments of Scotland (Baynes, 2019) and Wales also declaring a climate emergency in both April and May. However, the legislation is not legally enforceable, and means the government is not obliged to undertake any action (BBC News, 2019e). However, in the wake of this climate emergency, the then Prime Minister, Theresa May, announced that the United Kingdom agreed to alter the United Kingdom's carbon emission reductions from 80 per cent by 2050 to become net carbon neutral by 2050 (BEIS and Skidmore, 2019).

These climate emergencies come after the Intergovernmental Panel on Climate Change announced in October 2018, that society only has twelve years to stop the worst of climate change (Watts, 2018). This was after a report, which states that instead of keeping temperatures under 1.5^{o}C, the planet was heading for 3^{o}C of warming (IPCC, 2018). Because of this increase in warming, it would experience more extreme weather events, both within the United Kingdom and across the planet.

Lastly, it has been noted that there has been an increase in the number of protests that are aimed at mitigating against climate change within the United Kingdom during 2019, including via "Extinction Rebellion" and "School Strike for Climate". It is possible that this increase in protest is due in part to the warning given by the Intergovernmental Panel on Climate Change. However, the protests raise questions on who comprises these groups, what are their overall aims, whether the public are supportive of these reactions and are motivated to join future protests.

7.4. Extinction Rebellion

Extinction Rebellion, founded in May 2018, is a political and social movement orientated to mass civil disobedience and non-violent behaviour within cities around the world, to confront climate change induced ecological collapse (Extinction Rebellion, No Date). The group have cited other past grassroots movements, including suffragettes and the civil rights movements (Taylor and Gayle, 2018). These movements have previously used civil disobedience to achieve attention and support for their cause. Extinction Rebellion supports some of its members in actively getting arrested to attract attention (*Extinction Rebellion: Last Chance to Save the World?*, 2019; Smoke, 2019). Despite these actions, it has attracted a large amount of support from academics and celebrities (Extinction Rebellion, 2019).

The largest protest that Extinction Rebellion have organised occurred for eleven days between the 15th and 25th April 2019 in Central London. The groups protest shut down parts of central London, including Marble Arch, Oxford Circus, Piccadilly Circus, Parliament Square and Waterloo Bridge. In addition, the group's members were responsible for criminal damage to the headquarters of 'Royal Dutch Shell', and glued themselves to trains at Canary Wharf. Consequently, Metropolitan Police estimate that 1,130 people were arrested during the eleven-day protest. These protests were the main news stories for numerous days throughout the two week period that they occurred, and as such the group succeeded in drawing attention towards climate change; there was a 39 per cent increase in newspaper reports on climate change in April compared to the previous month, and further increases in May (Boykoff *et al.*, 2020). Since then, Extinction Rebellion declared a “summer uprising”, which expanded out of London to the cities of Bristol (Walker, 2019), Cardiff (Murray and Storer, 2020), Edinburgh (Spowart, 2018), Leeds (Sheridan, 2020) and Newcastle (MacFarlane, 2019); and even to the Crown Dependency of Jersey (ITV, 2019).

During the April 2019 protests in London, two surveys were conducted amongst the public which asked of how supportive they were during the event. The first was conducted during the first two days of the protest (Kenward, 2019), and the second was taken during the third day of protests (YouGov, 2019b). The results show that the overall level of support declined from 46 per cent (Kenward, 2019) to 36 per cent by the third day of the protest (YouGov, 2019b). This decline in support for the protests coincided with the disruption of public transportation within London. Two activists had climbed on top of a Dockland Light Railway train; whilst another glued himself to a train at Canary Wharf (Hartley-Parkinson, 2019). This drop-in support is likely to be in part influenced by the alienation of commuters who were trying to get to work. In addition to this, the headline figure of £7 million being spent on policing for these protests within London in April 2019 (Jarvis, 2019), is likely to have also undermined the support for the group.

Since these protests that Extinction Rebellion undertook in London, its actions have moved to a more international focus; with protests in both 2019 and 2020 in Australia (Webb, 2019), France (BBC, 2019f), Germany (Nasr, 2019), New Zealand (Webb, 2019), Netherlands (BBC, 2019f) and the United States (Tracy, 2019).

7.4.1. Awareness of Extinction Rebellion

Despite the media attention that Extinction Rebellion achieved throughout 2019, especially during the London protests in April, there are non-consumers of news who may not know who this group are. Within the second questionnaire, the respondents were asked “Have you heard of "Extinction Rebellion" before today?”. In which the respondents were given three options, ‘yes’, ‘no’ and ‘don’t know’. If they either answered ‘no’ or ‘don’t know’, they were asked to not complete any further questions about Extinction Rebellion within this survey, to stop them giving an uninformed opinion on the group.

Table 7.2 records that the majority of the respondents [63.1 per cent] had heard of the group before the day of been questioned. However, due to the level of the media interest in the group as mentioned earlier, it would be expected that this number would be higher. This seems to suggest that there is a fairly large proportion of the public that are not readily connected to current events which others regard as being nationally or globally newsworthy. The implications of this going forward in terms of climate change could be significant, where it is going to be increasingly more difficult to rely on major communication channels for the latest information about climate change, which is the basis of a significant proportion of societies reactions to it.

When observing the socio-demographic differences, it can be observed that there are significant differences within each socio-demographic group regard the direct action represented by Extinction Rebellion, some trends standing out. The first is the differences between the different age groups. It was observed that young people (18-24) are the only age group without a majority having heard of Extinction Rebellion. Secondly, males are 20.4 per cent more likely to have heard of Extinction Rebellion compared to females. As for the case of age group, this raises questions about the differences in which men and women are consuming news about environmental issues. Thirdly, it is noted that London had a much higher proportion of respondents having heard of Extinction Rebellion compared to the overall average [85.2 per cent versus 63.1 per cent respectively]. This is not surprising, as the largest protests organised by Extinction Rebellion took place in central London, affecting the way in which the people of London were going about their business.

However, London is not the most likely region to have heard of Extinction Rebellion, with South West England being the highest at 87.1 per cent. The reason for why this region both has such a high knowledge score and is above London which has been the most effected by the protest is somewhat surprising. Some potential reasons include that Bristol, which is the largest city in the region, had a large protest in July 2019, including the blocking of the M32 causing major traffic delays throughout the nearby region (BBC News, 2019g). These delays resulted in somebody being unable to get the bedside of his dying father in time, which caused anger towards the group in the region as reported within the media at that time (Buck, 2019; Keay, 2019; Morrison, 2019). The other potential reason for the high knowledge of Extinction Rebellion score could be partly because, as demonstrated with Table 7.2, individuals who have a centre politics identification, including the Liberal Democrats, are the most likely to have higher knowledge score in this context. The South West of England traditionally is a region within which Liberal Democrats have scored highly in general elections.

Despite of these difference being suggested in explaining why the South West result was highest in the UK, there is nonetheless not a significantly significant difference between the proportion that have heard of Extinction Rebellion within London and the South West England ($\chi2$=0.222, p=0.637).

Overall, it the data suggested that those who are over the age of 65 years, male, of white ethnicity, with a centre political identification and from the South West of England were more likely to have heard about Extinction Rebellion than other groups.

Table 7.2 –Proportion of respondents that had heard of Extinction Rebellion in the summer 2019

	Yes	No	Don't Know	Refused	Total	Sig.
Overall	1071 63.1%	585 34.5%	41 2.4%	3 0.2%	**1,700**	
Age Group						
18-24	155 38.9%	226 56.8%	16 4.0%	1 0.3%	**397**	**0.000*****
25-34	173 59.5%	110 37.8%	7 2.4%	1 0.3%	**291**	
35-44	170 65.4%	83 31.9%	7 2.7%	0 0.0%	**260**	
45-54	221 73.4%	77 25.6%	2 0.7%	1 0.3%	**301**	
55-64	212 77.4%	57 20.8%	5 1.8%	0 0.0%	**274**	
65+	135 79.4%	31 18.2%	4 2.4%	0 0.0%	**170**	
Gender						
Male	525 75.0%	158 22.6%	16 2.3%	1 0.1%	**700**	**0.000*****
Female	536 54.6%	419 42.7%	24 2.4%	2 0.2%	**981**	
Political Identification						
Left	579 65.7%	285 32.3%	15 1.7%	2 0.2%	**881**	**0.009*****
Centre	194 70.8%	75 27.4%	5 1.8%	0 0.0%	**274**	
Right	124 62.6%	72 36.4%	2 1.0%	0 0.0%	**198**	
Brexit Party	21 51.2%	16 39.0%	4 9.8%	0 0.0%	**41**	

Table 7.2 –Proportion of Respondents that had Heard of Extinction Rebellion in the summer 2019 (Continued)

	Yes	No	Don't Know	Refused	Total	Sig.
Ethnicity						
White	987 63.2%	538 34.4%	36 2.3%	1 0.1%	**1,562**	**0.000*** **
Ethnic Minority	49 50.0%	42 42.9%	5 5.1%	2 2.0%	**98**	
Hometown						
North East England	120 47.6%	125 49.6%	5 2.0%	2 0.8%	**252**	**0.000*** **
North West England	117 57.4%	79 38.7%	8 3.9%	0 0.0%	**204**	
Yorkshire & the Humber	72 53.3%	57 42.2%	6 4.4%	0 0.0%	**135**	
East Midlands	44 62.0%	27 38.0%	0 0.0%	0 0.0%	**71**	
West Midlands	45 76.3%	14 23.7%	0 0.0%	0 0.0%	**59**	
East of England	67 72.0%	24 25.8%	2 2.2%	0 0.0%	**93**	
London	121 85.2%	17 12.0%	4 2.8%	0 0.0%	**142**	
South East England	120 67.8%	54 30.5%	3 1.7%	0 0.0%	**177**	
South West England	148 87.1%	22 12.9%	0 0.0%	0 0.0%	**170**	
Wales	27 84.4%	5 15.6%	0 0.0%	0 0.0%	**32**	
Scotland	95 71.4%	37 27.8%	1 0.8%	0 0.0%	**133**	
Northern Ireland	24 36.9%	40 61.5%	1 1.5%	0 0.0%	**65**	
Crown Dependencies	1 50.0%	1 50.0%	0 0.0%	0 0.0%	**2**	

Sig. = Significant; * = 99 per cent significance; Note: All Percentages might not add up to 100 per cent due to rounding errors**

Source: Author

7.4.2. Support for Extinction Rebellion

It is arguable that any action group wanting to achieve the support that will make their cause heard, needs to have the support of the general public. Out of those who have heard of Extinction Rebellion, the respondents were then asked; "are you overall supportive of the views of "Extinction Rebellion"?". The responses to this question were measured using a Likert Scale between 1 and 5, with '1' meaning ‘not supportive’ and ‘5’ ‘supportive’. Within Table 7.3, the scores of 1 and 2 were merged in the output for ‘not supportive’, with 4 and 5 meaning ‘supportive’.

The resultant data shows that the level of support for Extinction Rebellion declines for older age groups. It is arguable that this is to be expected, as it roughly follows a similar trend compared with the seriousness of climate change, as demonstrated within Figure 5.12. The exception in this trend is with the age group ’45-54’. Firstly, this may be because responses from this age group are more homogeneous around the supportive category compared to any other age group [including the ’18-24’ age group], as this age group achieved a 75.3 per cent for the ‘supportive’ response.

Probably, the most salient within supportiveness of Extinction Rebellion based on socio-demographic data is the political identification of the respondents. It is highlighted that both the left and centre voter respondents are overwhelming supportive of the Extinction Rebellion goals with 82.1 per cent and 80.8 per cent, respectively. This compares to those who are either from a right-wing party or the Brexit Party, which are 26.2 supportive and 20.0 per cent supportive. When comparing the difference between the centre voting respondents to the right voting respondents, it was found that there was a significant difference between sets of respondents, at a 99 per cent significance ($\chi2=92.607$, $p=0.000$***). This striking difference is almost reminiscent of differences in climate change perception within the United States. It remains to be seen if Extinction Rebellion protests could result in growing political divides in climate change perception in the future, but as Chapter Five demonstrates there are divides within the United Kingdom.

Overall, the results in Table 7.3 demonstrate that:

- Respondents who are female, between the ages of 18 and 24, that are typically a more left-wing voter, of white ethnicity, and are from East of England are typically the most supportive of Extinction Rebellion’s beliefs and goals.
- Respondents who are male, over the age of 65, that are typically more likely to be a voter of the Brexit Party and are an ethnic minority are typically the least supportive of Extinction Rebellion’s belief and goals. Scotland and Northern Ireland show slightly lower levels of support.

This overall evaluation of perception of Extinction Rebellion then raises questions as to why people are supportive or not supportive of the movement. Within the questionnaire, after given the score about Extinction Rebellion, the respondents were given the opportunity to justify the score given. Some of these points are to be explored in the remainder of this sub-section.

Table 7.3 – Proportion of respondents supportive of Extinction Rebellion in the summer of 2019

	Not Supportive	Medium Supportive	Supportive	Mean	Total	Sig.
Overall	151 14.2%	166 15.6%	746 70.2%	**3.85**	**1,063**	
Age Group						
18-24	15 9.7%	25 16.2%	114 74.0%	**4.01**	**154**	**0.002*** **
25-34	117 9.8%	28 16.2%	128 74.0%	**3.98**	**173**	
35-44	29 17.2%	21 12.4%	119 70.4%	**3.83**	**169**	
45-54	27 12.3%	27 12.3%	165 75.3%	**3.97**	**219**	
55-64	28 13.2%	42 19.8%	142 67.0%	**3.81**	**212**	
65+	33 25.0%	23 17.4%	76 57.6%	**3.39**	**132**	
Gender						
Male	100 19.2%	87 16.7%	333 64.0%	**3.66**	**520**	**0.000*** **
Female	46 8.6%	78 14.6%	409 76.7%	**4.06**	**533**	
Political Identification						
Left	33 5.7%	70 12.1%	474 82.1%	**4.23**	**577**	**0.000*** **
Centre	8 4.1%	29 15.0%	156 80.8%	**4.13**	**193**	
Right	61 50.0%	29 23.8%	32 26.2%	**2.48**	**122**	
Brexit Party	12 60.0%	4 20.0%	4 20.0%	**2.15**	**20**	
Ethnicity						
White	131 13.4%	150 15.3%	698 71.3%	**3.88**	**979**	**0.104**
Ethnic Minority	10 20.4%	11 22.4%	28 57.1%	**3.51**	**49**	
Hometown						
North East England	16 13.4%	23 19.3%	80 67.2%	**3.86**	**119**	**0.439**
North West England	15 12.8%	17 14.5%	85 72.6%	**3.92**	**117**	
Yorkshire & the Humber	12 17.1%	12 17.1%	46 65.7%	**3.71**	**70**	
East Midlands	11 25.0%	4 9.1%	29 65.9%	**3.66**	**44**	

Table 7.3 – Proportion of Respondents Supportive of Extinction Rebellion in the Summer of 2019 (Continued)

	Not Supportive	Medium Supportive	Supportive	Mean	Total	Sig.
West Midlands	6 13.3%	9 20.0%	30 66.7%	**3.82**	**45**	**0.439**
East of England	4 6.0%	9 13.4%	54 80.6%	**4.12**	**67**	
London	11 9.2%	13 10.9%	95 79.8%	**4.08**	**119**	
South East England	18 15.3%	16 13.6%	84 71.2%	**3.84**	**118**	
South West England	18 12.2%	18 12.2%	111 75.5%	**3.97**	**147**	
Wales	4 1.8%	5 18.5%	18 66.7%	**3.81**	**27**	
Scotland	15 15.8%	18 18.9%	62 65.3%	**2.73**	**95**	
Northern Ireland	6 25.0%	4 16.7%	14 58.3%	**3.58**	**24**	
Crown Dependencies	0 0.0%	0 0.0%	1 100.0%	**4.00**	**1**	

Sig. = Significant; * = 99 per cent significance; Note: All Percentages might not add up to 100 per cent due to rounding errors**

Source: Author.

When exploring why Extinction Rebellion has a general level of support amongst the respondents, a common theme arose concerning government urgency in tackling the issue of climate change. This is demonstrated by respondent CCAA0067 who said that “climate change is a serious issue that the government isn’t engaging with to the extent that it should” [Female, 18-24, West Midlands], and respondent CCAA0048 who said that “Governments and large global companies just don’t care about the environment, they say they do but barely anything ever changes until there is unrest” [Male, 18-24, North East England]. These are clear case respondents that care about climate change and think that if the government will not respond to it more urgently, they will support a group that will help make this happen.

Respondent CCAA0107 similarly states that they “mostly support the views of Extinction Rebellion based on their views that enough is enough with regards to climate change politics [and that] for years … government policies with regards to the issue have never really reflected the severity of the problem” [Male, 18-24, North East England]. However, they go further and explain how they understand the reasoning behind “Extinction Rebellion's attitude that if politicians won't choose to listen to the science, we shall have to make them listen through the use of public outcry". This is an example of the previously introduced 'post-normal engagement', where the public are feeling that they are doing their bit to reduce their personal carbon emissions, but government are not legislating to focus others to make their contribution.

However, some are worried about Extinction Rebellion potential tactics to bring the message to the public. For example, respondent CCAA0126 state that they "would have been 'fully supportive' [5] had the news not mentioned ER [Extinction Rebellion] using drones to disrupt flights to Heathrow" [Male, 35-44, Scotland]. It should be noted that this questionnaire was taken in early June 2019, when a splinter group from Extinction Rebellion called 'Heathrow Pause' have adapted to shut down Heathrow Airport using the drones within the Heathrow exclusion zone. Whilst it is debated the level of involvement of Extinction Rebellion in the Heathrow Pause protest, it is known that there was an arrest in September 2019, for alleged attempting to fly a drone near Heathrow Airport (Hockaday, 2019). These types of actions have, for some, turned them away from supporting the group. Respondent CCAA1378 stated that they did not "like the extreme way they are tackling the issue, for example Heathrow shut-down plan" [Male, 65+, *Unknown*]. They go on by stating "this will only anger the public and we should be getting them on board!". This respondent raises a point, that there is a very real danger that the very nature of civil disobedience protest, could lead to major disruption in the lives of many individuals who are concerned about issues of climate change, but frustration and anger of having their lives being disrupted could lead to a backlash against climate movements.

A further prominent event that occurred during 2019 via Extinction Rebellion outside of the Easter London Protest which led to anger amongst the public exemplifies how the very nature of protests will cause disruption.

During the protest that took place 17th October 2019, an 83-year-old man glued himself to the side of a train and others jumped on the top of the train to try and stop it moving at Canning Town tube station, London (Gayle and Quinn, 2019). This led to scuffles as commuters attempted to drag off protesters from trains in attempt to stop disruption. Whilst, this protest gathered a lot of media attention to their group and the cause, it is arguable that most of this was negative. The protest had taken place after the closure of the activism survey for this thesis, and so there is no data available from the survey. However, media outlets facilitated debates about the appropriateness of this protest, including through media programmes such as 'Good Morning Britain', 'This Morning' and 'Loose Women'. Extinction Rebellion admitted, in a Facebook Post, that they were wrong for targeting public transportation. However, from the respondents, there were already concerns about Extinction Rebellion targeting public transportation before this event. Respondent CCAA0107 had referred to the “light irony that these protests have often affected those using public transport, a method of transportation which is often regarded as a 'cleaner' alternative to using cars” [Male, 18-24, North East England]. This response is supported by respondent CCAA1614 who stated that they think that “nearly all their actions are brilliant but one or two have been own goals such as stopping public transport systems that have to be part of the solution” [Male, 55-64, South West England]. , respondent CCAA1409 stated that “delaying [and/or] preventing commuters from using buses and trains was contradictory to the aim of getting people out of private cars and into public transport to reduce pollution” [Female, 45-54, South East England]. This belief was also held by respondent CCAA1485 who stated that “obstructing public transport actively undermines carbon reduction” [Male, 35-44, South West England].

This is probably one the biggest issues that Extinction Rebellion have faced, what and who are they targeting by way of protest. In this case, the targeting of public transportation in London has two main issues. The first is that if the group want people to be greener, the use of public transport is needed; on this day, it was reported that several commuters had to either jump into a car or taxi, which in turn resulted in more greenhouse gas emissions being emitted. The other is that in this case they are targeting working class people, which need to get to work to be able to pay the bills, and this action could detrimentally impact on these individual’s ability to do so. These types of actions led to one respondent [CCAB0061] stating that they “believe in what they stand for (as a general principle) but their actions make me doubt their integrity” [Male, 25-34, South East England]. This is the problem that Extinction Rebellion could face in future years, as if the group loses integrity amongst the public, the group could be looked down upon.

7.4.3. Supportive of Extinction Rebellion’s London Protest

A change in the level of support for Extinction Rebellion in the aftermath of the more substantive protest in April 2019 within the centre of London across the United Kingdom might be expected.

To test the level of support Extinction Rebellion achieved for the London Protest, the respondents were asked “How supportive are you of "Extinction Rebellion" protests in central London during April 2019?”. As with the previous question, the respondents were given the same scale of 1 to 5. Given the questions are similar, it means that a direct comparison can be made to determine whether there is any difference and whether this difference is significant. Figure 7.2 demonstrates the overall level of support for Extinction Rebellions protest in London in April 2019. This also includes the proportion of respondents not answering, as they had not heard of the group before the survey.

Figure 7.2 demonstrates that the most selected category was ‘have not heard’. After that, the most popular choice is the option 5, showing that there was still a high level of support for the action that the group undertook despite the media reports of anger and concerns about Extinction Rebellion’s actions that were raised in the previous section.

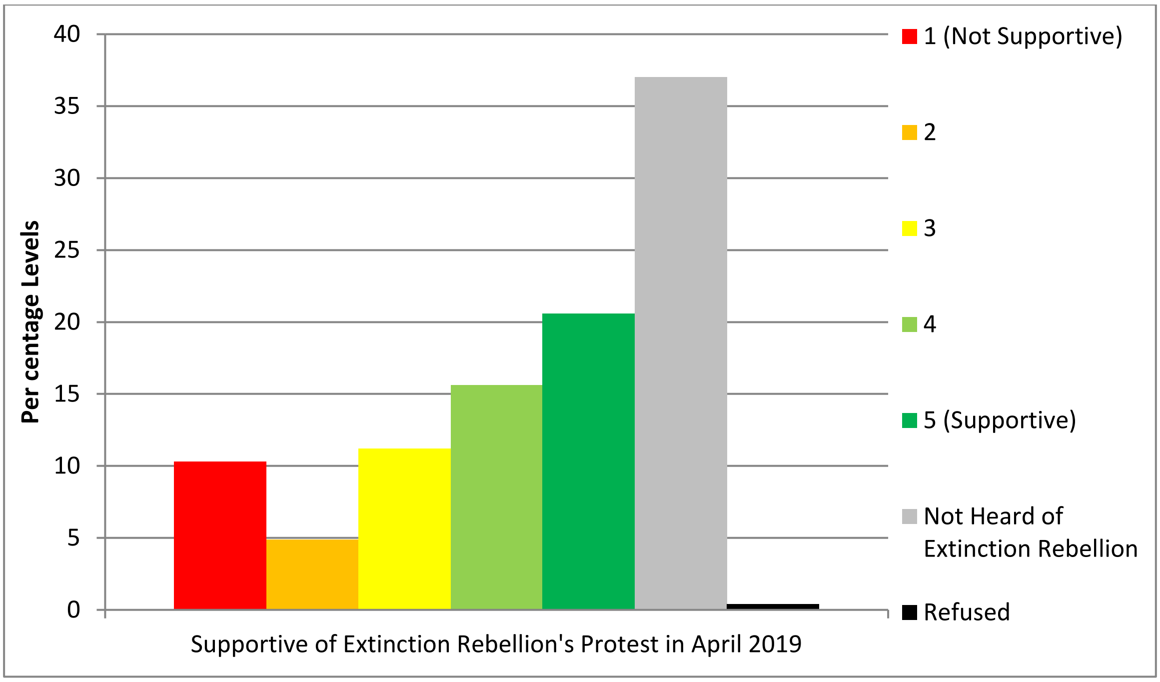


Figure 7.2 – Respondents Support of Extinction Rebellion’s Protest in April 2019 Between May and August, 2019.

Source: Author.

Figure 7.2 and Table 7.4 both demonstrate that there is still a majority that support Extinction Rebellion protests in Central London in April 2019, with 57.8 per cent of these respondents having heard of the group. However, as demonstrated with Table 7.5, there has been a significant increase (10.1 per cent) in the overall number of people who are not supportive of the group’s actions in April 2019 ($\chi 2$=, $p=0.000$***).

The supportiveness of Extinction Rebellion as a group was the highest amongst the young people. However, this age group’s support declines to third place in supportiveness of Extinction Rebellion’s actions during the April 2019 protest in London. This is, as demonstrated within Table 7.5, due to the decline in overall support within age group ’18-24’, with a mean decline score of 0.44 or a 15.9 per cent decline in the supportive category. This demonstrates that it is the young people who know of the group who are welcoming of Extinction Rebellion and their goals. However, they are not welcoming of what some might perceive as extreme and criminal behaviour to capture the public’s and politicians' attention to the group and issue it represents. Going forward, Extinction Rebellion has signalled that they would like to attract more young people to the movement. This demonstrates that if they do want to get the support of this targeted group, then they will have to change their approach to protesting.

Table 7.4 – Proportion of respondents supportive of Extinction Rebellion's Protest in April 2019

	Not Supportive	Medium Supportive	Supportive	Mean	Total	Sig.
Overall	259 24.3%	190 17.8%	616 57.8%	**3.50**	**1,065**	
			Age Group			
18-24	31 20.0%	34 21.9%	90 58.1%	**3.57**	**155**	**0.000*** **
25-34	31 17.9%	37 21.4%	105 60.7%	**3.65**	**173**	
35-44	46 27.2%	21 12.4%	102 60.4%	**3.54**	**169**	
45-54	44 20.2%	29 13.3%	145 66.5%	**3.73**	**218**	
55-64	54 25.6%	39 18.5%	118 55.9%	**3.43**	**211**	
65+	51 37.8%	30 22.2%	54 40.0%	**2.91**	**135**	
			Gender			
Male	158 30.2%	92 17.6%	273 52.2%	**3.29**	**523**	**0.000*** **
Female	95 17.9%	97 18.2%	340 63.9%	**3.73**	**532**	
			Political Identification			
Left	64 11.1%	92 15.9%	421 73.0%	**4.00**	**577**	**0.000*** **
Centre	30 15.5%	48 24.9%	115 59.6%	**3.68**	**193**	
Right	85 68.5%	22 17.7%	17 13.7%	**1.94**	**124**	
Brexit Party	16 84.2%	1 5.3%	2 10.5%	**1.68**	**19**	
			Ethnicity			
White	232 23.6%	178 18.1%	571 58.2%	**3.52**	**981**	**0.886**
Ethnic Minority	13 26.5%	9 18.4%	27 55.1%	**3.43**	**49**	

Table 7.4 – Proportion of Respondents Supportive of Extinction Rebellion's Protest in April 2019 (Continued)

	Not Supportive	Medium Supportive	Supportive	Mean	Total	Sig.
Hometown						
North East England	30 25.2%	29 24.4%	60 50.4%	**3.39**	**119**	
North West England	25 21.6%	16 13.8%	75 64.7%	**3.63**	**116**	
Yorkshire & the Humber	18 25.4%	13 18.3%	40 56.3%	**3.46**	**71**	
East Midlands	15 34.1%	6 13.6%	23 52.3%	**3.32**	**44**	
West Midlands	9 20.0%	9 20.0%	27 60.0%	**3.51**	**45**	
East of England	8 11.9%	15 22.4%	44 65.7%	**3.90**	**67**	
London	21 17.5%	19 15.8%	80 66.7%	**3.77**	**120**	**0.216**
South East England	36 30.0%	15 12.5%	69 57.5%	**3.41**	**120**	
South West England	32 21.8%	24 16.3%	91 61.9%	**3.61**	**147**	
Wales	6 23.1%	6 23.1%	14 53.8%	**3.42**	**26**	
Scotland	27 28.4%	18 18.9%	50 52.6%	**3.36**	**95**	
Northern Ireland	7 29.2%	7 29.2%	10 41.7%	**3.08**	**24**	
Crown Dependencies	0 0.0%	0 0.0%	1 100.0%	**4.00**	**1**	

Sig. = Significant; * = 99 per cent significance; Note: All Percentages might not add up to 100 per cent due to rounding errors. Note: Significance scores are between the three groups of supportiveness and each of the socio factors.**

Source: Author

The data suggests overall that:

- Respondents who are aged between 45 and 54, are female, have a more left-wing political identification, are of white ethnicity and from the East of England are the most likely to be supportive of Extinction Rebellion's London Protests in April 2019.
- Respondents who are over the age of 65, are male, are typically Brexit Party voters, are an ethnic minority and who are from Northern Ireland are the least likely to be supportive of Extinction Rebellion's London Protest in April 2019.

Because of low respondent numbers, those who are from the Crown Dependences are not being included in the individual break-down.

Table 7.5 – Difference in support for Extinction Rebellion's beliefs and Extinction Rebellion's London protest

	Not Supportive	Medium Supportive	Supportive	Mean Difference
Overall	+10.1%***	+2.2%	-12.4%***	**-0.35**
Age Group				
18-24	+10.3%**	+5.7%	-15.9%***	**-0.44**
25-34	+8.1%***	+5.2%***	-13.3%**	**-0.33**
35-44	+10.0%**	=0.0%	-10.0%*	**-0.29**
45-54	+7.9%**	+1.0%	-8.8%**	**-0.24**
55-64	+12.4%***	-1.3%	-11.1%**	**-0.38**
65+	+12.8%**	+4.8%	-17.6%***	**-0.48**
Gender				
Male	+11.0%***	+0.9%	-11.8%***	**-0.37**
Female	+9.3%***	+3.6%	-12.8%***	**-0.33**
Political Identification				
Left	+5.4%***	+3.8%*	-9.1%***	**-0.23**
Centre	+11.0%***	+9.9%**	-21.2%***	**-0.45**
Right	+18.5%***	-6.1%	-12.5%**	**-0.54**
Brexit Party	+24.2%*	-14.7%	-9.5%	**-0.47**
Ethnicity				
White	+10.2%***	+2.8%*	-13.1%***	**-0.36**
Ethnic Minority	+6.4%	-4.0%	-2.0%	**-0.08**
Hometown				
North East England	+11.8%**	+5.1%	-16.8%***	**-0.47**
North West England	+8.8%*	-0.7%	-7.9%	**-0.29**
Yorkshire & the Humber	+8.3%	+1.2%	-9.4%	**-0.25**
East Midlands	+9.1%	+4.5%	-13.6%	**-0.34**
West Midlands	+6.7%	=0.0%	-6.7%	**-0.31**
East of England	+5.9%	+9.0%	-14.9%*	**-0.22**
London	+8.3%*	+4.9%	-13.1%**	**-0.31**
South East England	+14.7%***	-1.1%	-13.7%**	**-0.43**
South West England	+9.6%**	+4.1%	-13.6%**	**-0.36**
Wales	+21.3%	+4.6%	-12.9%	**-0.39**
Scotland	+12.6%**	=0.0%	-12.7%*	**-0.63**
Northern Ireland	+4.2%	+13.0%	-16.6%	**-0.50**
Crown Dependencies	=0.0%	=0.0%	=0.0%	**0.00**

*** = 90 per cent significance; ** = 95 per cent significance; *** = 99 per cent significance; Note: All Percentages might not add up to 100 per cent due to rounding errors.**

Source: Author

This data indicated that the respondents who:

- Indicate the least decline in support due to the protest action that were carried out in the centre of London in April 2019 are amongst those who are aged between 45 and 54, are female, have a left-wing political identification, are of an ethnic minority and are from the East of England.
- Have the largest decline in support due to the protest action in the centre of London in April 2019 are those over the age of 65, male, who have a more right-wing political identification, who have a white ethnicity, and are from Scotland.

As demonstrated in Table 7.5, there have been significant changes across a multitude of differing social factors when comparing the levels of support for Extinction Rebellion as a whole and the support for their actions during the London Protests in April 2019. Table 7.5 suggests that those who either ranked their level of support of the group overall at '4' or '5' on a Likert Scale moved their support levels to either a '1' or '2' due to the London action. However, when examining the Sankey diagram in Figure 7.3, it is found that when the level of support was falling, it usually only fell either to the 1 or 2 levels. Within each of the five levels of support for Extinction Rebellion overall roughly 50 per cent or more maintained the same level of support for the actions Extinction Rebellion undertook through the April 2019 protests. It is also found that only a very few people increased their level of support between the surveys, with most of the increases being from support level '3' or '4', and these generally only increased by one level.

A reduced level of support for Extinction Rebellion following the London Protest in April 2019 may be explained by a common theme amongst the respondents concerning the disruption to the lives of workers and residents in the vicinity of the protests. This is demonstrated by respondent CCAA0618 who stated that "the protests inconvenienced many regular people and were easily ignored by those who actually have the power to change" [Male, 25-34, South West England]. This is backed up by respondent CCAA0714 who stated that the protest was simply an "inconvenience for innocent commuters going about their business [and it] is not the way to go. It's the government that needs to be inconvenienced" [Female, 45-54, West Midlands]. These two quotes raise an issue as to what stage a protest becomes a disruption that reinforces anger and the government ignoring them (CCAA0618). If so, the Extinction Rebellion protests cannot achieve much good. However, a month after these protests, new targets set out in the Climate Change Act 2008 were proposed and passed by the government. It is not possible to prove the protests played an active role, but if they did would this fully justify the protests?

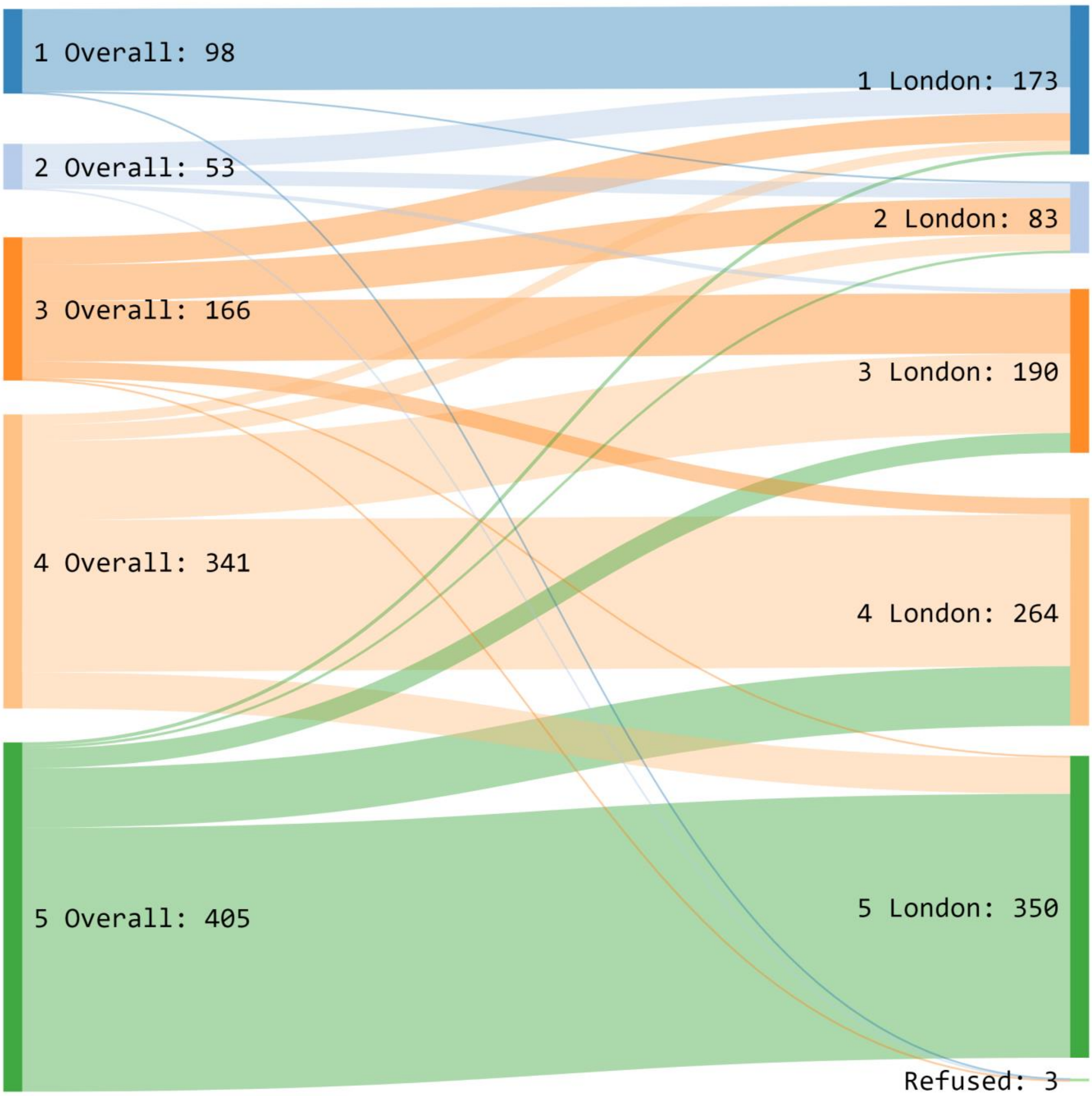


Figure 7.3 – Sankey Diagram Demonstrating Changing Support for Extinction Rebellion (Source: Author)

Whether the responses indicated by these protests achieve change, actions that disrupt people have other negative issues associated. The biggest issue, which has been raised repeatedly throughout responses to the questionnaire, is the increased carbon emissions and air pollution that the disruption was causing. This disruption occurred in two different ways, the first by the protesting on public transportation and the other through blocking the roads. In terms of public transportation, it has already been raised throughout this section by numerous respondents who questioned whether forcing interruptions to public transportation is actually counter intuitive. A moral issue is raised as to the trade off in delaying public transportation for impact but resulting in the short-term a greater amount of carbon emissions being emitted. This is symptomatic of the wider consideration of what reactions are justified in focusing the government to legislate on the population to reduce their carbon emissions in the medium to long term. Research that was conducted by automotive market researchers [Sophus3] found that during the Extinction Rebellion protest in central London, there was a 56 per cent increase in the online traffic seeking electric vehicles (AM, 2019). Whilst this does not necessarily mean that the protest resulted in more people buying electric vehicles, it does suggest people being nudged[51] into their own research for the means to cleaner private transportation. By blocking the roads, it has been argued by one media pundit, that Extinction Rebellion have demonstrated what the future cities would look like with less vehicles in terms of cleaner air and the quieter streets (Chatterton, 2019), instead of the increasing the negative impact on people's physical health including through hypertension and cardiovascular diseases (Basner *et al.,* 2014). These conditions result in 12,000 people dying each year prematurely within the European Union with 48,000 new cases of heart disease (EEA, 2020) as a consquence of air pollution.

However, other outcomes of the protests may aim to promote a more climate scepticism/denier viewpoint. For example, Respondent CCAA0235 believes that the action of "causing inconvenience to the everyday human doesn't help to further the argument that we need to address climate change, only allowing parties in the media to drag the discourse through the mud by demonising them" [Male, 18-24, North East England]. This has been demonstrated through various media outlets in the aftermath of this protest. Examples include the interview on Sky News by Adam Boulton during these protests which lead to Extinction Rebellion's spokesperson to walk out mid interview (Griffin, 2019); or the opinion piece in the Daily Express titled "Protests such as Extinction Rebellion show we've lost the plot" (Ferrari, 2019). Both of these pieces have tried to paint the group in a negative light and make them look like hypocrites. The potential effect that this could have on the general public is that those who already have some degree of scepticism of climate change will see these type of news stories in a way that potentially further seeds doubt, or counter-resistance, in their mind. This is demonstrated by respondent CCAA0163, who stated that the protests were "layered in hypocrisy, demonstrated by Emma Thompson who made the trip – first class – on a jumbo jet from LA [Los Angeles, United States]" [Male, 18-24, North East England].

[51] - Nudged theory is the concept that propounds the idea of positive reinforcement and indirect suggestion as a method of influencing behaviour and the decision making of either an individual or a group (Simon and Tagliabue, 2018).

However, not all the respondents changed their perception with elements of negative undertones; some were complementary of the protests. For example, respondent CCAB0027 stated that “the impact of the protest was the media coverage & getting this issue out their” [Female, 55-64, South West England]. Other respondents such as CCAB0031 stated that “these protests successfully brought attention to the subject” [Female, 55-64, North West England]. Despite what has been highlighted earlier, are consistent with a view that ‘all publicity is good publicity’.

7.4.4. Likely to Join Extinction Rebellion Protest

As highlighted in the previous section, the London Protests had influenced increasing numbers of respondents to believe that this is not the ideal way to approach the issue of climate change. However, a majority still believe it is the right or only way. That then raises a query as to whether belief is followed by action indicated by whether these respondents would join the group in protesting. Accordingly, the respondents of the second survey, were asked “How likely are you to join "Extinction Rebellion" on a protest in the future?”. The question was deliberately worded vaguely, especially given the time scale, as it gave a greater understanding of the level of support amongst the respondents about the actions of the group. Using the Likert scale Table 7.6 provides the outcome with ‘3’ meaning a ‘medium likelihood’ and a score of ‘4’ or ‘5’ meaning that the respondent was ‘likely’ to take action.

It was found within Table 7.6 that there is some degree of polarisation in the responses, but in general the respondents stated that they were not likely to join a future Extinction Rebellion protest, with a mean score of 2.48 out of 5, giving a value ‘3’ as the middle point. This also demonstrates a lack of appetite to join an Extinction Rebellion type protest by many.

However, in terms of young people, it was found that they are more likely to join the protests compared to any other age group, with a response of likely 6.7 per cent higher than any other age group. It should also be noted that in terms of different socio-demographic factors that are considered within the survey, the age group ’18-24’ were the second most likely to join these protests if they had a more left-wing political identification, being ranked higher at 2.91 instead of the mean score of 2.85.

Table 7.6 – How likely are respondents to join an Extinction Rebellion protest

	Not Likely	Medium Likelihood	Likely	Mean	Sig.
Overall	572 (53.7%)	212 (19.9%)	282 (26.5%)	**2.48**	
Age Group					
18-24	66 (42.6%)	32 (20.6%)	57 (36.8%)	**2.85**	**0.001*** **
25-34	82 (47.4%)	39 (22.5%)	52 (30.1%)	**2.66**	
35-44	91 (53.5%)	40 (23.5%)	39 (22.9%)	**2.37**	
45-54	118 (53.9%)	40 (18.3%)	61 (27.9%)	**2.53**	
55-64	123 (58.6%)	32 (15.2%)	55 (26.2%)	**2.43**	
65+	90 (66.7%)	27 (20.0%)	18 (13.3%)	**1.98**	
Gender					
Male	309 (59.2%)	99 (19.0%)	114 (21.8%)	**2.29**	**0.003*** **
Female	256 (47.9%)	112 (21.0%)	166 (31.1%)	**2.68**	
Political Identification					
Left	233 (40.3%)	131 (22.7%)	214 (37.0%)	**2.91**	**0.000*** **
Centre	103 (53.4%)	48 (24.9%)	42 (21.8%)	**2.46**	
Right	107 (86.3%)	11 (8.9%)	6 (4.8%)	**1.43**	
Brexit Party	18 (90.0%)	1 (5.0%)	1 (5.0%)	**1.30**	
Ethnicity					
White	528 (53.8%)	196 (20.0%)	258 (26.3%)	**2.48**	**0.796**
Ethnic Minority	25 (51.0%)	9 (18.4%)	15 (30.6%)	**2.55**	
Hometown					
North East England	61 (51.3%)	22 (18.5%)	36 (30.3%)	**2.61**	**0.788**
North West England	57 (48.7%)	28 (23.9%)	32 (27.4%)	**2.56**	
Yorkshire & the Humber	38 (53.5%)	11 (15.5%)	22 (31.0%)	**2.55**	
East Midlands	26 (59.1%)	7 (15.9%)	11 (25.0%)	**2.25**	
West Midlands	28 (62.2%)	8 (17.8%)	9 (20.0%)	**2.40**	
East of England	33 (50.0%)	15 (22.7%)	18 (27.3%)	**2.53**	
London	52 (43.3%)	30 (25.0%)	38 (31.7%)	**2.74**	
South East England	67 (55.8%)	23 (19.2%)	30 (25.0%)	**2.42**	
South West England	74 (50.0%)	33 (22.3%)	41 (27.7%)	**2.57**	
Wales	17 (63.0%)	4 (14.8%)	6 (22.2%)	**2.30**	
Scotland	56 (58.9%)	20 (21.1%)	19 (20.0%)	**2.31**	
Northern Ireland	16 (66.7%)	2 (8.3%)	6 (25.0%)	**2.17**	
Crown Dependencies	1 (100.0%)	0 (0.0%)	0 (0.0%)	**2.00**	

Sig. = Significant; * = 99 per cent significance; Note: All Percentages might not add up to 100 per cent due to rounding errors.**

Source: Author.

One reason why respondents are overall reluctant to join an Extinction Rebellion protest relates to their targeting. Respondent CCAA0765 stated that they would not join them as they think the group is "targeting the wrong people when they discuss preventing access to Heathrow airport to have a long awaited and much saved for holiday. How many didn't get to job interviews or other important engagements" [Female, 45-54, East of England]. Although many responses may be mirroring what is reported in the media, another respondent [CCAA0856] may be indicative of many in stating that they would prefer to engage with the issue in a different way. They stated that they are "happy to listen, to take notes on how I can make a difference" [Female, 35-44, East Midlands]. Whilst this individual does not want to participate in activism sense, the very actions of the group Extinction Rebellion means that they are listening and making informed decisions and choices about climate change engagement strategies through both mitigation and adaption from the individual level.

It therefore can be concluded that the respondents:

- Who are the more likely to join the Extinction Rebellion are those between 18 and 24 years old, are female, who have a more left-wing political identification, are of an ethnic minority and are from London.
- Who are the least likely to join the Extinction Rebellion are those over the age of 65 years, are male, are more likely to vote for the Brexit Party, are white and from Northern Ireland. [Crown Dependencies not included in survey due to low response rate from these areas].

7.4.5. What Next?

Since this information on reactions to Extinction Rebellion was undertaken for this thesis, the group have continued carrying out major operations and protests with regular frequency in London and other major cities within the United Kingdom and around the world. A further dynamic has therefore been whether the protests are considered more or less acceptable to the public in the COVID-19 context. During the initial first few months of the COVID-19 pandemic, Extinction Rebellion reduced actions, to allow the population to focus on an immediate threat to society. However, as the initial wave of COVID-19 passed within the United Kingdom, the level of activity of Extinction Rebellion has been steadily increasing, with protests being observed in late August and early September. This is despite warnings from the police and other governmental authorities not to stage these protests due to the ongoing threat that COVID-19 pandemic raises. Ethical and moral questions relate to the appropriateness of civil disobedience protests during the COVID-19 pandemic world. Table 7.5 and Figure 7.3 indicate that the protests in London during April 2019 resulted in some negative attitudes to the group, which could result in negative attitudes towards the climate change movement during this period. It is arguable that if hosting a protest during a pandemic, when many people are still not able to return to work properly, might host some resentment and negative attitudes to the group and might have an impact on the public perception of climate change. This could especially be the case if any cases or cluster of cases of COVID-19 can directly be attributed to these protests.

However, with this mind, COVID-19 may make people begin to realise that there are some connections between climate change impacts and zoonotic disease events, due to the destruction of environmental stability and encroachment of human's into new habitations, which have zoonotic diseases that humanity is susceptible to. This has been observed in recent years outside of COVID-19, for example for the cases of Ebola[52]; and Dengue Fever[53].

It should be noted that Extinction Rebellion are not purely about climate change, despite the messaging within media. The Extinction Rebellion focus is about risk of a social [humans] and ecological collapse due to anthropogenic activities. Within this framework, it is arguable that zoonotic disease events, such as COVID-19, are a clear example of what Extinction Rebellion has been warning the public about in recent years.

7.5. School Strike for Climate Change

"School Strike for Climate Change" is an international action being carried out by children who are missing class to demand action on climate change. It should be noted that student's striking for climate change is not a new concept. In 2015, over 50,000 students in 100 countries demonstrated on the first day of the 2015 United Nations Climate Change Conference in Paris.

The current wave of "School Strike for Climate Change" was started by the then 15-year-old Swedish school student, Greta Thunberg, who held school boycotts and protested outside the Swedish Riksdag [Parliament] in August 2018 (Crouch, 2018). The concept amongst young people grew, and as of the end of January 2019, around 100,000 have striked from school, with strikes occurring in at least 20 countries. This includes Australia (Albeck-Ripka, 2018; Wilkinson, 2018; Zhou, 2018), Belgium (Roth

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[52] - Ebola is a viral haemorrhagic fever that affects humans and other eutherian mammals which is caused by the ebolaviruses; it has a fatality rate of between 25 and 90 per cent, with the average being 50 per cent (WHO, 2014). Ebola was first discovered in 1976 in Yambuku, Zaire [now Democratic Republic of the Congo] (WHO, 2014). Since then, there have been numerous minor outbreaks throughout Sub-Sahara Africa. However, in recent years, there have been two major outbreaks, in 2013-16; and 2018-20. The 2013-16 outbreak was the biggest outbreak, with 28,646 cases and 11,323 fatalities (WHO, 2020a). In all outbreaks, it has been started by the consumption of infected bush meat (WHO, 2014).

[53] - Dengue fever is a mosquito-borne disease, which infects roughly up to 400 million people per year (WHO, 2020b). It is expected that as the planet continues to warm due to climate change, the mosquitos that carry both strains of dengue fever will encroach into new territories, increasing the number of people exposed and vulnerable to contracting Dengue Fever. This change in the location of Dengue Fever, due to a changing climate, has already been observed. In 2014, Japan recorded its first case of nationally obtained in over 70 years, and an outbreak occurred in Tokyo, resulting in 160 people becoming infected during the late summer (Kutsuna *et al.,* 2015). Both Rogers (2015) and Kraemer *et al.* (2015) are both reporting a small change in the latitude distribution of Dengue Fever since 1960 has moved slightly outwards towards the poles.

and Salhi, 2019), Canada (Larsen, 2018), Finland, Germany, Netherlands, Sweden (Crouch, 2018), Switzerland and the United Kingdom (Henderson, 2019; Singleton, 2019).

In comparison to Extinction Rebellion, School Strike for Climate Change is a more traditional striking method, and which usually only occurs on a Friday. Ahead of the first major meeting its founder Greta Thunberg stated that:

> *"We, the young, are deeply concerned about our future. … We are the voiceless future of humanity. We will no longer accept this injustice. … We finally need to treat the climate crisis as a crisis. It is the biggest threat in human history and we will not accept the world's decision-makers' inaction that threatens our entire civilisation. … Climate change is already happening. People did die, are dying and will die because of it, but we can and will stop this madness. … United we will rise until we see climate justice. We demand the world's decision-makers take responsibility and solve this crisis. You have failed us in the past. If you continue failing us in the future, we, the young people, will make change happen by ourselves. The youth of this world has started to move and we will not rest again".*
>
> Greta Thunberg (2019, Online)

This speech published in the Guardian highlights a call to action based on young people having been left without a voice on climate change, whilst it is perceived the problem is that the governments around the world have lacked the leadership to make decisions and take actions to mitigate against climate change.

7.5.1. Awareness of the School Strikes for Climate Change

Following from differences highlighted between the differing socio groups that had heard of Extinction Rebellion further data can compare the case of 'School Strike for Climate Change'. Participants during the second questionnaire from this thesis in the Spring and Summer of 2019, were asked 'Have you ever heard of "School Strike for Climate" before today?'.

As demonstrated within Table 7.7 the overall number of respondents that had heard of 'School Strike for Climate Change' is 79.4 per cent, which differ in comparison to Extinction Rebellion at 63.1 per cent, as demonstrated within Table 7.1. However, the increases in percentages are variable across the different socio-demographics groups.

Table 7.7 – Respondents who have heard of the School Strike for Climate Change group

	Yes		No	Don't Know	Refused	Total
		XR Diff				
Overall	1,350 (79.4%)	+16.3% ***	328 (19.3%)	12 (0.7%)	10 (0.6%)	**1,700**
Age Group (0.000*)**						
18-24	262 (65.8%)	+26.9%***	130 (32.7%)	5 (1.3%)	1 (0.3%)	**398**
25-34	202 (69.4%)	+9.9%***	83 (28.5%)	5 (1.7%)	1 (0.3%)	**291**
35-44	213 (81.9%)	+16.5%***	45 (17.3%)	1 (0.4%)	1 (0.4%)	**260**
45-54	258 (85.7%)	+12.3%***	41 (13.6%)	1 (0.3%)	1 (0.3%)	**301**
55-64	248 (90.5%)	+13.1%***	22 (8.0%)	0 (0.0%)	4 (1.5%)	**274**
65+	163 (95.9%)	+16.5%***	6 (3.5%)	0 (0.0%)	1 (0.6%)	**170**
Gender (0.005*)**						
Male	588 (84.0%)	+9.0%***	102 (14.6%)	4 (0.6%)	6 (0.9%)	**700**
Female	747 (76.1%)	+24.5%***	222 (22.6%)	8 (0.8%)	4 (0.4%)	**981**
Political Identification (0.006*)**						
Left	720 (81.7%)	+16.0%***	149 (16.9%)	8 (0.9%)	4 (0.5%)	**881**
Centre	230 (83.9%)	+13.1%***	37 (13.5%)	2 (0.7%)	5 (1.8%)	**274**
Right	157 (79.3%)	+16.7%***	41 (20.7%)	0 (0.0%)	0 (0.0%)	**198**
Brexit Party	26 (63.4%)	+12.2%	14 (34.1%)	0 (0.0%)	1 (2.4%)	**41**
Ethnicity (0.000*)**						
White	1,250 (80.0%)	+16.8%***	295 (18.9%)	8 (0.5%)	9 (0.6%)	**1,562**
Ethnic Minority	66 (67.3%)	+17.3%**	28 (28.6%)	4 (4.1%)	0 (0.0%)	**98**
Hometown (0.000*)**						
North East England	159 (63.1%)	+15.5%***	89 (35.3%)	3 (1.2%)	1 (0.4%)	**252**
North West England	176 (86.3%)	+28.9%***	26 (12.7%)	0 (0.0%)	2 (1.0%)	**204**
Yorkshire & the Humber	105 (77.8%)	+24.5%***	29 (21.5%)	1 (0.7%)	0 (0.0%)	**135**
East Midlands	61 (85.9%)	+23.9%***	9 (12.7%)	1 (1.4%)	0 (0.0%)	**71**
West Midlands	48 (81.4%)	+5.1%	10 (16.9%)	0 (0.0%)	1 (1.7%)	**59**
East of England	77 (82.8%)	+10.8%*	15 (16.1%)	0 (0.0%)	1 (1.1%)	**93**
London	122 (85.9%)	+0.7%	17 (12.0%)	2 (1.4%)	1 (0.7%)	**142**
South East England	143 (80.8%)	+13.0%***	34 (19.2%)	0 (0.0%)	0 (0.0%)	**177**
South West England	152 (89.4%)	+2.3%	14 (8.2%)	1 (0.6%)	3 (1.8%)	**170**
Wales	28 (87.5%)	+3.1%	3 (9.4%)	0 (0.0%)	1 (3.1%)	**32**
Scotland	125 (94.0%)	+22.6%***	8 (6.0%)	0 (0.0%)	0 (0.0%)	**133**
Northern Ireland	39 (60.0%)	+23.1%***	26 (40.0%)	0 (0.0%)	0 (0.0%)	**65**
Crown Dependencies	2 (100.0%)	+50.0%	0 (0.0%)	0 (0.0%)	0 (0.0%)	**2**

XR = Extinction Rebellion; * = 90 per cent significance; ** = 95 per cent significance; * = 99 per cent significance.**

Source: Author

The spread observed between the different age groups within Table 7.2 is 40.5 per cent for the Extinction Rebellion compared to 30.1 per cent within Table 7.7. There is a gulf between young people and older people in their knowledge of the 'School Strike for Climate Change'. This is highlighted by a 12.5 per cent difference between the age groups '25-34' and '35-44', which is significant at the 95 per cent level ($\chi2=6.528$, $p=0.011$**).

One potential reason behind the large difference amongst the youngest respondent age group within the survey is that they are of the same age of those joining the protest or are more likely to know people from school/college that have joined the protest. Also, those who are aged between 25 and 34, are probably the most unlikely to have any connection to these protests, due to being at least seven years older than the upper age expected for these protests and less likely to have a relative involved compared to the other age groups.

Lastly, it is demonstrated that there are significant differences (99 per cent level) between the ways in which the respondents have knowledge of this protest group compared to Extinction Rebellion across each of the socio-demographic factors.

7.5.2. Supportive of Children Striking for Climate Change

Whilst the majority of the respondents have heard of the School Strike for Climate Change protest movement, this raises the question as to the level of support from the public/respondents for children striking to raise attention for climate change. Therefore, all the respondents within the second survey, were asked "How supportive are you of children striking for climate change during a school day?". The phrasing of this question includes 'during a school day', for two reasons; firstly, most of the protests take place during a Friday in term time; the second is that given children missing school to strike is contentious, it gives more emphasis.

Table 7.8 demonstrates that overall, the respondents are supportive of children missing school to strike for climate change, with 63.5 per cent being supportive with a mean score of 3.68 out of 5. When examining the level of support amongst young people, it was found that it was above the average support score, with a score of 4 out 5. However, this is slightly lower compared to the 25 to 34 age group, that has a supportive score of 4.03 out of 5, with 1.9 per cent more respondents being supportive of students striking. This does not represent a significant difference between the two age groups ($\chi2=0.230$, $p=0.632$).

More left-wing leaning voters (58.2 per cent) were likely to support children striking for climate change compared to right-wing leaning voters mirroring the thoughts of politicians in Westminster during the same time of the survey. For example, the then prime minister, Theresa May of the Conservative Party [right-wing] criticised pupils who were missing lessons, stating the consequence of their actions will “increases teachers' workloads and wastes lesson time" (McGuinness, 2019, Online). This compares to the Leader of the Opposition at the time, Jeremy Corbyn of the Labour Party [left-wing] who at the time tweeted “I support the young people striking today and thank them for taking action” (Corbyn, 2019, Online). These polarised feelings about children striking in the name of climate change is not just being observed within the United Kingdom, with similar divides are being observed within, for example, Australia and New Zealand.

One of the themes in the criticism that was observed within the survey was that the students were using a school day to protest. An example of this is respondent CCAA0489 who stated that it would be “much more sensible to have such protests on a Saturday then young people can protest and still have a valuable education” [Female, 55-64, Northern Ireland]. This view is mirrored by respondent CCAA1158 who stated that “The same message could be set with a march/gathering at a weekend or in school holidays”, however, they go on further to say that “many 'strikers' simply treated this as a chance to miss school and this in itself dilutes the integrity and thereby strength of the message” [Male, 35-44, South East England]. On the first point of this, it is probably argued by many that in an ideal world the protests should be taken when the children are not supposed to be in school. But, as James Shaw, the New Zealand Minister for Climate Change, at the time of the initial criticism stated, “when you’re fighting for your future, and you are trying to get the attention of those whom you feel have let you down, following the rules and marching on the weekend isn’t going to cut it” (Daly, 2019). On the point from the second respondent about the strikers are only taking part to skip school, this view is also indicated by CCAA0117 who stated that “the kids just use it as an excuse to skip school” and who went on to inform that they “know a few people who have actually done that” [Male, 18-24, North East England]. Whilst there is no way to back up what the respondent is claiming here there is a question as to how serious some of the strikers view the issue, there being a lack of research on it.

Within the survey another major criticism is that the children do not really understand what they are protesting about. This is demonstrated with respondent CCAA0177 who states that “Many of these children don’t fully understand the issues at hand and instead are being used as good PR on behalf of parents and teachers who do support climate change action” [Male, 18-24, Yorkshire and the Humber].

Respondent CCAA0526 stated that “awareness is raised through education not through missing education” [Male, 35-44, Northern Ireland] with a comment from respondent CCAA0860 that “children need to be taught about the importance of this but not be out of school disrupting learning”

[Male, 45-54, West Midlands]. These two latter statements were also highlighted in Section 6.2, whereby the education of climate change within the United Kingdom is shown to be lacking. This response raises the point that maybe educating the students about the causation of and the threats that climate change poses, is another way of awareness raising more widely. Respondent CCAA0660 from the survey, thought to be a teacher, stated about the protests that “if conducted as part of the managed curriculum in school, it works well”, and then goes on to explain that they combined the protest with “part of our Literacy work and it reached the local paper that weekend” [Male, 45-54, North West England]. This raises that trying to combine important social issues with other subjects outside of the conventional geography and science subjects, potentially has helped the student to understand more about the issue of climate change and develop other important education skills and tools.

Respondent CCAA0811 stated that they do not believe “children should have the responsibility for direct action nor the worry of things beyond their years” [Female, 45-54, South East England]. Some believe that it is important to allow children to grow carefree and not to worry about big societal issues when growing up, being important for a happy childhood, especially since the increase in young people that are suffering from eco or climate anxiety (see section 1.3). However, it can alternatively be argued that these respondents are failing to recognise that young people want a voice. Until these protests, there was no real mechanism that gives young people a chance to have a say about what should be done in climate change, despite their being the people who are most likely to be affected by climate change in a significant way. It is argued through this thesis that this lack of voice is another example of a lack of post-normal science within the United Kingdom needed to tackle climate change. This is the reasoning that respondent CCAA0326 draws upon in being supportive of the movement, as they believe “it’s their future, they will have to suffer the consequences of climate change the longest so it is appropriate that they are passionate about the issue” [Male, 18-24, North East England].

Table 7.8 affirms that most of the respondents are supportive of these protests. This is for various reasons, but the main reason, which is highlighted by respondent CCAB0020, is that they believe that the student strikes shows that young people “care about the climate, and that everyone - schools, government, companies, adults, peers - can do something about it.” [Male, 25-34, Refused].

This data suggests that:

- Those who are the most supportive of children striking for climate change are those between the ages of 25 and 34, are female, have a left-wing political identification, are of ethnic minority and are from London.

- Those who are the least supportive of children striking for climate change are those over the age of 65, are male, would vote for the Brexit Party, are of white ethnicity, and are from Northern Ireland.

Table 7.8 – Levels of support for the children striking for climate change

	Not Supportive	Medium Supportive	Supportive	Mean
Overall	308 (22.9%)	183 (13.6%)	853 (63.5%)	**3.68**
Age Group (0.000*)**				
18-24	39 (14.9%)	31 (11.8%)	192 (73.3%)	**4.00**
25-34	28 (13.9%)	22 (10.9%)	152 (75.2%)	**4.03**
35-44	53 (24.9%)	31 (14.6%)	129 (60.6%)	**3.65**
45-54	64 (25.0%)	35 (13.7%)	157 (61.3%)	**3.64**
55-64	71 (29.0%)	39 (15.9%)	135 (55.1%)	**3.40**
65+	52 (31.9%)	24 (14.7%)	87 (53.4%)	**3.28**
Gender (0.000*)**				
Male	175 (29.9%)	66 (11.3%)	345 (58.9%)	**3.47**
Female	128 (17.2%)	116 (15.6%)	500 (67.2%)	**3.85**
Political Identification (0.000*)**				
Left	76 (10.6%)	77 (10.7%)	564 (78.7%)	**4.19**
Centre	40 (17.5%)	40 (17.5%)	149 (65.1%)	**3.80**
Right	101 (64.7%)	23 (14.7%)	32 (20.5%)	**2.15**
Brexit Party	18 (69.2%)	3 (11.5%)	5 (19.2%)	**2.00**
Ethnicity (0.820)				
White	286 (23.0%)	168 (13.5%)	790 (63.5%)	**3.68**
Ethnic Minority	13 (19.7%)	9 (13.6%)	44 (66.7%)	**3.79**
Hometown (0.532)				
North East England	37 (23.3%)	22 (13.8%)	100 (62.9%)	**3.69**
North West England	34 (19.5%)	31 (17.8%)	109 (62.6%)	**3.72**
Yorkshire & the Humber	20 (19.4%)	11 (10.7%)	72 (69.9%)	**3.81**
East Midlands	15 (24.6%)	9 (14.8%)	37 (60.7%)	**3.67**
West Midlands	10 (20.8%)	6 (12.5%)	32 (66.7%)	**3.69**
East of England	23 (29.9%)	8 (10.4%)	46 (59.7%)	**3.55**
London	19 (15.6%)	17 (13.9%)	86 (70.5%)	**3.90**
South East England	42 (29.4%)	17 (11.9%)	84 (58.7%)	**3.44**
South West England	38 (25.3%)	19 (12.7%)	93 (62.0%)	**3.65**
Wales	5 (17.9%)	2 (7.1%)	21 (75.0%)	**3.82**
Scotland	27 (21.6%)	20 (16.0%)	78 (62.4%)	**3.73**
Northern Ireland	13 (33.3%)	7 (17.9%)	19 (48.7%)	**3.28**
Crown Dependencies	0 (0.0%)	0 (0.0)	2 (100.0%)	**5.00**

***N* = 1,344**

Source: Author

7.5.3. What Next?

At the time of writing this thesis, society is in the middle of the COVID-19 pandemic, causing major disruptions to society and how it goes about its business. One of the greatest disruptions that has been felt is the closing of schools in March 2020, in some cases for six months. Whilst, during the closure of schools, students were set work by the teachers, many will have fallen behind, and students have not been given an adequate and comparative learning experience as they experienced before the pandemic. In addition, research from this period is suggesting that many of the students have not completed the work set by the teachers (Sellgren, 2020). Consequently, all students are behind in their work and at a national level there have been discussions about how best students can catch up. The question of child development is important when looking at the School Strike for Climate protests. As highlighted through the previous three sections, the group were gathering a sizeable momentum in getting their message about climate change across. They have tried to keep some of that momentum by a form of virtual strikes (Murray, 2020). However, it is likely not to have been as effective as the original protests.

Going forward, whilst some students will be influenced by an argument based on why they need to learn anything from school when their future is at risk, few, if any, will doubt the importance of the education of children. It will be harder to justify when students are far behind already, that they skip school to protest about climate change. It is possible that the children could strike at the weekend in their own time, but that then raises whether the impact of these protests would be as great; a concern particularly if not all students were really committed to the cause of climate change.

7.6. Climate Assembly

As introduced earlier within this chapter, the United Kingdom decided to increase its commitment to mitigating climate change through reducing greenhouse gases emission. This was achieved through increasing the cuts expected to be achieved from an 80 per cent reduction by 2050 compared to 1990 levels, legislated in the Climate Change Act 2008, to 100 per cent reduction in the same time frame, as set out through an amendment in mid-2019. Despite, this pledge to make the United Kingdom 'net zero' by 2050, it has been demonstrated within Section 5.11.1 of this thesis, that only 35.5 per cent of the population have heard of the term to which this policy is applied (Adapted from BEIS, 2020d). However, it is arguable that the pressure from the protests by 'Extinction Rebellion' and the 'School Strike for Climate Change' has played some impact on the government's willingness in bring the United Kingdom's pioneering legislation goals. Whilst Forrester, Gerger Swartling and Lonsale (2008) do not highlight the importance of this in their work, it is tenable that 'civil disobedience' and 'activism' is a low-level form of post-normal science, reconstituted by this thesis as post-normal engagement. As during the early 2019, the United Kingdom had seen more of the general population and academics coming together than previous in "engaging" feelings towards the government to bring new legislation to help achieve carbon emission reductions.

Because of this building pressure on the government through the public, academia and the media about climate change, in June 2019, six Select Committees from the Houses of Parliament called for a citizens' assembly on climate change (Climate Assembly, No Date). Due to this, the assembly was created just before the then current sitting parliament was dissolved for the December 2019 election, and were given the title/slogan of 'Climate Assembly UK: the path of net zero'. The aim of this assembly was for representatives from the general public to come together, and with guidance and collaboration of academics, raise ideas on how the United Kingdom can change its infrastructure and the way it does business to achieve the goal of net carbon zero by 2050 (Climate Assembly, No Date). The assembly workshops had taken place between January and May 2020, originally taking place in Birmingham, but as the COVID-19 pandemic started to ravage the way in society worked, it moved to being virtual. The Climate Assembly was originally chosen when 30,000 random households were contacted and asked if they were interested in taking part, out of this 1,500 people wanted to take part, then out of this pool of people 110 were selected by computer, in this respect considered to be a rough proportion of the United Kingdom population (Murray, 2020), which will mean that all different socio-demographic groups will have a chance to have their voices heard due to this process.

This is the first time in which members of the public were actively asked to discuss climate change and give ideas and thoughts about climate change. When referring to Figure 7.2, this type of exercise resembles a form of 'post-normal science' engagement, as defined by Forrester, Gerger Swartling and Lonsale (2008). Whilst a direct link cannot be made between the role of the protests that had taken place in early 2019 and the Climate Assembly, it can be gainsay that the post-normal engagement represented by the protests had played a role in this post-normal science taking place.

Whilst, at the time of writing this chapter, the Climate Assembly is yet to report and is expected to in either September or October 2020. These findings when published will be presented to the government. Time will see whether the government will act on any of the findings within the report.

Whilst the Climate Assembly is a good first step towards a full scale 'post-normal science' approach in trying to combat climate change; it still does not go far enough. As mentioned earlier, for a full 'post-normal science' approach to be undertaken, it needs all three stakeholders [civil society, academia AND politicians] operating in an open learning environment. Currently, whilst the politicians are receiving the reports and potentially could be debating them in parliament and/or at Select

Committees during the autumn and winter of 2020, the process of the Climate Assembly might be more advantageous if a representation of politicians had taken part as well throughout the process. This means that politicians could give their expertise about politics when discussing such matters about climate change.

In addition, going forward, further questions surround whether there will be any more Climate Assemblies or other such opportunities for acting out engagement processes that actively engage with civil society on climate change, or whether this Climate Assembly was a one off. In this case, it could construe as a tokenistic response, being still far from the paradigmatic shift implied as necessary in this thesis.

7.7. Summary

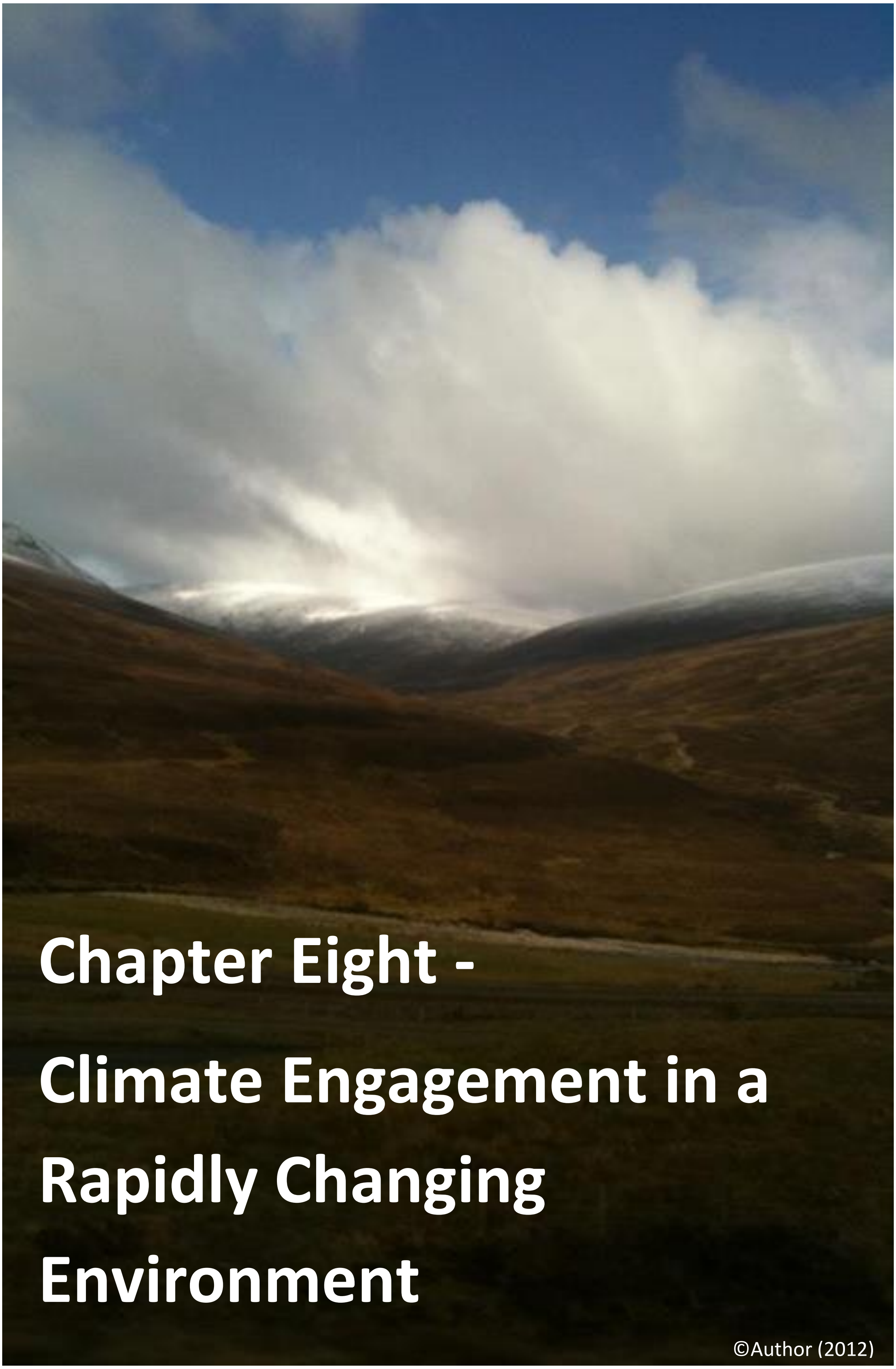
There are multiple different challenges governments face in trying to combat climate change. However, one potential way in which this can begin to be overcome is through a post-normal science approach. Until early 2019, this was not an approach considered within the United Kingdom. This led to barriers in communication between the scientists, politicians and the public itself. Consequently, with increasingly extreme weather being observed within both the United Kingdom and the rest of the planet, combined with the warnings from scientists via the IPCC special report in late 2018, there is now further warning of there being only about 12 years left to stop dangerous and potential runaway climate change. This situation is resulting in a post-normal engagement movement. The post-normal engagement is when people are confronted with a lack of action and create increased opportunities to make their voices heard outside of formal elections that target many issues. As examples of this consequence, ‘Extinction Rebellion’ and the ‘School Strike for Climate Change’ were formed. Whilst each of these groups have different ways in which they protest, and impact variously, they both have the common aim of trying to raise awareness of the threat of climate change to present and future generations, and to put pressure on the government to legislate more in trying to get both the public and organisations to mitigate against climate change.

Extinction Rebellion are a non-violent civil disobedience group that uses the approach of disrupting people’s daily lives to raise awareness, which the media are more than willing to report, thus bringing attention to climate change. Despite the media attention the group have been receiving over the course of the last two years, only 63.1 per cent of the sample of 1,700 had ever heard of the group by the time of the survey on this movement for this thesis. In terms of the proportion of young people [18-24] that had heard of this group, this figure was much lower being only 38.9 per cent. Whilst they are overall raising awareness of climate change, this had less impact than expected on the younger population (the group Extinction Rebellion are assumed to have wanted to attract). Despite this, the levels of support for Extinction Rebellion of those who have heard of the group is generally strong. However, when examining the levels of support for Extinction Rebellion's London protest, it was found there was a reduced level of mean support of 0.35 on the Likert scale across all age groups, with young people having being observed to have an above average decline of 0.44. This suggests that the Extinction Rebellion route to post-normal engagement, based on major civil disobedience, may be less effective as it would continue including young people.

Regards the other major protest group to come out of 2018/2019 era, 'School Strike for Climate Change' founded and led international by Swedish teenage activist Greta Thunberg, the research for this chapter found that respondents were more likely to have heard of it in comparison to Extinction Rebellion [79.4 per cent], despite the latter group having had more media attention. This seems to suggest that the school strike is having a more widespread grassroots attention. It is found that that young people [18-24] were much more likely to have heard of this protest compared to Extinction Rebellion compared to other age groups. When it came to levels of support for the group, the majority of those who had heard of it were supportive of children skipping classes to protest climate change [63.5 percent], with the respondents giving reasons of the youngest in society needing to have the ability to have their voices heard and that it shows they care about their environment around them. However, critics argue that they are disrupting themselves and other students, with some students using the strikes as an excuse to get out of classes for the day. This has led to some arguing that the protests should be moved to a Saturday, but others believe that the impact will be greatly reduced if compromises are made. Going forward, the short-term future of these protests is in doubt due to the COVID-19 pandemic, leading to the moral and ethical debate about losing more education when the students are already so far behind in their learning. Alternatively, COVID-19 may be seen as a new opportunity for youth to reassert their awareness of what is happening to the planet and how radical shifts in the way society has lived in and alternative way in recent months could provide the insight needed into how to offset further damage.

As highlighted at the beginning of this chapter, one of potential ways to move forward collectively as a country to combat climate change is through a post-normal science framework. The government seemingly tried to do this during late 2019/early 2020, with the Climate Assembly, which invited selected respondents to participate in a number of debates to gather thoughts and ideas from members of public with support of academics. It is arguably the case that this has occurred on the back of the 'post-normal engagement' that occurred through the medium of the protests by Extinction Rebellion and the School Strikes for Climate Change; and that this Climate Assembly is the real demonstration by the United Kingdom government of attempts to engage with post-normal science. However, the assembly is yet to report and with the complexity that the COVID-19 pandemic is posing to the United Kingdom on a social, health and economic fronts. This Climate Assembly could run the risk of being reduced to a tokenistic exercise, ironically just when climate and COVID-19 linkages through natural resources issues would suggest the approach should be further intensified.

The results of this chapter indicate political divides. These divides emerge larger than any past research undertaken related to climate change within the United Kingdom, resembling more of the United States perception differences. As introduced in Section 3.1, political divide in perception on climate change within the United Kingdom has been generally not so extreme, but with divides of 58.2 per cent in support of children striking between the left-wing respondents and right-wing respondents. It raises questions as to whether these political divides in effect determine climate activism and protest, a form of polarised cultural persuasion linked to political orientations similar in trajectory to the United States and apart from climate change realities.



Chapter Eight - Climate Engagement in a Rapidly Changing Environment

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"the only thing we have to fear is … fear itself – nameless, unreasoning, unjustified terror which paralyzes needed efforts to convert return into advance."

Franklin D. Roosevelt, 32nd President of United States

Roosevelt (1933)

This thesis set out to explore and develop potential answers to five main questions that are presented at the end of Chapter 3 to test the conceptual framework reflected by Figure 3.10. Outcomes of the research, summarised within this chapter, prompt evaluative revision of the conceptual framework and climate related research and engagement directions for the post-COVID-19 pandemic world.

8.1. Influences of Climate Change Perception

The first research question of this thesis concerned; "What influences perception of current and future adverse climate change impacts?". This question was explored by first considering different socio-economic factors that might be having an influence on perception and second the role of the media and how it might also be having an influence.

8.1.1. Socio-economic factors

As highlighted in the conceptual framework and within Chapter 3.2, there are varied factors that might influence the perception of climate change within the United Kingdom and the Crown Dependences, of which the influence of four are summarised as follows below.

8.1.1.1. Age

Youth participation, as highlighted in this thesis meant comparing those under the age of 25 years old with other age groups. It has been found that in general young people believe that climate change is a greater threat to society compared to any other issues. This included the coronavirus during the middle period of the COVID-19 pandemic, though this group was the only group to rate it as such, as demonstrated in Section 5.1. It has also been found that whilst they have a similar belief compared to the rest of the population in terms of their perception of climate change having an impact at the local level, they are more likely, compared to other age groups, to believe that climate change is having an impact at the national and international level [Figure 5.6 and 5.7]. Other age groups also take have the wider perspective on climate change impacts but to a lesser extent than the young.

However, when exploring the individual impacts due to climate change on the United Kingdom, the youngest age group only ranked these highest for two of the impacts compared to the other age groups [Table 5.11].

In addition, for three of these impacts, young people were the least likely to believe they would impact the United Kingdom in the medium future. The older generation [65+] were regularly the least likely to acknowledge these impacts.

In terms of perception, it is concluded here that levels of scepticism and lack of concern about climate change tends to increase with age [Sections 5.3 and 5.5], which has also been observed within the United States (Ballew *et al.,* 2019). Despite this, young people are unable to name the impacts that climate change will unleash on the United Kingdom in the future. As explored in 5.4.1, young people have a lower level of life experience and therefore will have observed fewer changes in their lifetime compared to somebody in their 40s and 50s. In contrast, the oldest in society have been exposed to more conflicting information about the state of the climate during their lifetime, for example the 'global cooling' theory in the 1970s, meaning that their exposure to conflicting ideas and realities leaves them more sceptical, despite observing changes to the climate in their lifetime.

As such, despite a complex array of explanatory influences, it can be concluded that age influences perception of climate change amongst these respondents.

8.1.1.2. Social Groups and Household Income

Whilst people differentiated by social group and household income are not necessarily the same, there is often a strong correlation between the two (NRS, No Date) and these were considered together.

The findings in Chapter 5 generally found a relationship between a higher social grade and a more environmentally conscious perception of climate change. For example, in Table 5.7, social grade AB is less likely to believe that climate change is caused by natural processes or think that there is no such thing as climate change compared to social grade DE (0.0 per cent versus 9.3 per cent respectively amongst 16- to 24-year-olds). The social grade AB identify eight of the eleven impacts that might be happening more frequently compared to other social groups, whereas social group 'DE' identified none of the eleven impacts more so than other social groups. This is concerning, as social group 'DE' are more likely to be the most vulnerable to current and future climate change impacts. This is due to being the least likely to have any disposable income, many barely having enough to live on. This group is also the least likely to have any insurance against the threat of extreme meteorological events. This means their capacity to rebuild is low. They are not only vulnerable to climate change impacts within the United Kingdom, but also to impacts globally. As the projected impacts of climate change slowly ramps up, the amount of damaged crops will likely increase the cost of fresh food within British supermarkets by 20 per cent (Harvey, 2019). This increased unpredictability in crop growth means that food prices within both the United Kingdom and globally will be higher, meaning that those on the lowest income will face the highest risk of 'food insecurity'. COVID-19 already provides an example of how global disaster events can disrupt food supplies within the United Kingdom. Research has shown that when there is an increase in 'food insecurity', it is the most vulnerable in society who are at the highest risk due to combined lack of finance to buy more produce and the lack of availability of cheaper produce on supermarket shelves (Loopstra, 2020).

Varying perceptions are therefore not confined to scepticism of the science or to caring about the impacts of climate change. The issue of a lack of engagement with the crisis is more complex. Past research has demonstrated that during a period of economic instability, for example between 2008 and 2012, the concern about climate change issues declines, as individuals have to focus on the more immediate issues that are likely to threaten livelihoods and lives. This phenomenon has been termed a 'finite pool of worry' in the context of this thesis, but it is interested with the way that those in the lowest social grade generally have least income in society, whereby immediate financial concerns may be greater than more distant ones like climate change.

Consequently, it can be concluded that income and social status have an impact on the perception of climate change, with people with higher household incomes and of higher social grades being more concerned about the threat of climate change.

8.1.1.3. Political Identification

In terms of political identification, research in this thesis shows a divide (though relatively smaller than might be expected) between left- and right-wing voters, with right-wing being less concerned and more sceptical about climate change. These results are consistent with past research that has been undertaken on the issue of political identification within the United Kingdom in terms of climate perception (Whitmarsh, 2011). This is observed especially when exploring the level of support for the climate change protests of 2019, with those who are of a right-wing political identification being significantly more likely to be against this style of climate action. However, there is currently no recent data available to make definitive suggestions that there is an ever-increasing split between left-wing and right-wing voters in their level of acceptance of climate change. These results from the 2019 survey from this thesis show the greatest divide identified yet. This raises questions as to whether this was unique to the activism issues that have taken place in the United Kingdom [Tables 7.2 and 7.4], exposing greater societal polarisation over climate change and as such heading in a similar direction to how the United States started to go about twenty years ago.

8.1.1.4. Gender

It has been apparent in this research that there are potentially discernible differences between males and females in terms of climate change perception. Females were more likely to believe that there was no such thing as climate change or that it was caused by natural causes, but notably not significantly so. However, females were slightly more likely to believe that potential impacts were going to affect the United Kingdom in the medium term due to climate change. From this data, it can be concluded that there is no evidence that gender plays a significant role in the formation of perception of climate change within the United Kingdom. This was important to confirm since, as demonstrated within Section 3.2.1.2, there had been an existing debate in the literature about whether females or males are more environmentally concerned.

8.1.2. Other Factors

In addition to the socio-demographic factors, there are two other potential factors that arose within this thesis research that could have an impact on individual perception of climate change. These are adaptation so of the 'finite pool of worry' theory, in which past research by Weber (2006, p.115) suggests it is psychologically that people only have a 'finite pool of worry', and the 'media', which are summarised as follows.

8.1.2.1. Finite Pool of Worry

Within the latest report about climate change perception within the United States, Leiserowitz *et al.* (2020) found that the belief and worry about climate change has not reduced in times of the COVID-19 pandemic and lockdown. This means in this case, it would be expected that as concern for infectious diseases increases, concern for climate change would start to decrease. Whilst this thesis does not state that this theory definitely is correct or incorrect, it was recorded in Chapter 5 that a similar lack of concern for climate change occurred in the aftermath of the immediate Brexit crisis of 2016 within the United Kingdom. However, as climate change has become viewed by many as a fundamental issue that is going to have increasingly larger impacts on livelihoods and well-being in the future, other short to medium term issues will not impact on climate change beliefs overall. Evidence to date is that it is more likely that society has become so concerned about climate change that it is beginning to rank up amongst the shorter-term crisis issues. The 'finite pool of worry' theory can continue to be tested in the months and years ahead in the context of impacts of the COVID-19 pandemic on perceptions of climate change.

8.1.2.2. Media

As highlighted within this thesis, two types of media, traditional media and social media, are key influences on climate change communication and consequent perception. This research has demonstrated that the usage of traditional media in terms of finding out information about news is declining in recent years across all age groups, with more lured by social media. In addition, there has been a small steady increase in recent years in the proportion of the population that is consuming any media regularly. This might help to explain why there are respondents that had not heard of either 'School Strikes for Climate Change' and/or 'Extinction Rebellion'. These results are indicative of greater communication and media implications going forward.

Firstly, it is argued that it is important to understand how the scientific community has tried to communicate the dangers and newest information about climate change to those who do not regularly use the media to gather information about current affairs. It is arguable that those who do not know about the potential dangers in the short, medium and long term, increases the impact of extreme meteorological events associated with climate change as not knowing contributes to increasing vulnerability to these events. An example of this is demonstrated by Bichard and Kazmierczak (2012) who found that in England and Wales there was a significant relationship between climate change awareness and willingness in the adoption of flood protection at the local/domestic level.

Secondly, social media poses a threat to climate change narratives. Research has shown that ever increasingly the population, especially young people, are relying on social media to communicate about climate change. However, as highlighted by Björnberg *et al.* (2017) and Lazer *et al.* (2018), fake news via social media is a strategy being used by sceptics who lack qualifications in this field causing the propagation of misinformation about the risk and causation of climate change. Going forward, the scientific community are going to need to research and experiment with the ways to counter fake news, or society would continue to become more divided over the issue, especially across political ideological lines, as has been the case in the United States.

On the question as to whether media, and especially social media, is influencing the perception of climate change, as with the rest of this thesis, there needs to be a recognition of the complexity involved in interconnected phenomena of perception, engagement and reactions. If social media generates fake news, then young people, as the most prominent user of social media, are comparatively the most exposed to it, but not necessarily the most affected by it. It is noted here that the results through Chapter Five highlight that this generation is the most likely to believe in the severity of climate change. As such, social media-based scepticism about climate change is not generating a vast number of climate sceptics, although it could be argued that the concern about climate change might be higher without fake news. Further highly intricate research would need to be applied to prove this definitely in real time settings. However, it is likely that as research has demonstrated previous, and highlighted within Chapter Three, social media is likely to be a self-enforcing echo chamber facility for information about climate change, as there is likely to be an entrenchment of people with similar views and ideologies gathering around particular stances on it. Consequently, those people who believe in climate change are unlikely to read or to engage with people who are orientated to denial or who are sceptical about the significance of climate change and, though there may be fake or confused information, it is not helpful to lack understanding as to from where and in what way these perceptions are originating.

Lastly, it is arguable that social media has been a driving force for climate activism that has been observed within the United Kingdom during the last two years. Groups of activists use these platforms to promote protests and other activities. The importance of social media for climate activism has continued during the COVID-19 pandemic, as school strikes for climate change became virtual, also with the objective of flooding social media with protest messages about climate change (Murray, 2020).

8.2. Importance of Climate Change Education

During this research it was found that some educational institutions are not educating their students about natural processes, instead focusing on the anthropogenic activity as demonstrated in Section 6.3. The reason they have provided for this is not wanting to confuse students about such a complex issue. It is not deniable that climate change is a complex issue, for which individuals will have varying difficulty to fully understand. As demonstrated by past research, many students view greenhouse gases as an environmental issue instead of being a natural process (Koulaidis and Christidou, 1999; Myers, Boyes and Stanisstreet, 2004); as such students are not able to differentiate between the greenhouse effect, that is important for life on Earth, and the enhanced greenhouse effect, which is human induced environmental issue (Lambert, Lindgren and Bleicher, 2012). The lesson here is with respect to the importance of building an accurate picture of climate change for the students. This underpins fundamental influences on engagement in the short, medium and long-term future. If educators ignore and/or deny natural processes, it promotes distrust when the students later find out about the processes and consider why they were not taught about that before. The other reason is that without a full picture of climate change, students are becoming over pessimistic and defeatist about the future of the planet, when they do not have a full knowledge (Jonsson, Sarri and Alerby, 2012; Tan, 2013; Özdem *et al.*, 2014; Chang and Pascua, 2016).

8.3. Engagement and Disengagement Factors

In terms of willingness to engage with mitigation strategies, the age of the respondents was an influential factor. As demonstrated in Section 6.1, the levels of engagement amongst young people for mitigation strategies that required behaviour changes were high, whilst it was lower through the other age groups. However, when significant financial investment was required to undertake these engagement factors, it was found that the inverse was true, with the oldest in society most likely to undertake these mitigation strategies. A similar pattern was true for those with a high concern versus those with a low concern about climate change. For basic behaviour changes, those with a high level of concern for climate change were significantly more likely to undertake these strategies compared to those with lower levels of concern. When financial investments were needed, there was no significant difference between the two groups, with a slightly higher proportion for two of the strategies for those who do not believe that climate change is a serious problem [electric cars and insulation of houses]. These findings show engagement for these types of strategies as limited by household income. It is arguable that the low-income aspect is slowing down progress for the United Kingdom to become net zero, as strategies requiring higher incomes are likely to make the biggest difference in reducing the greenhouse gas emissions of individuals. Going forward, if the government are serious about their net zero ambitions, this financial divide in the accessibility of the highest reduction mitigation strategies will need reducing via government investment. Signs of this having been recognised are by way of, for example, the green home scheme that was introduced in September 2020, to help restart the economy after the COVID-19 lockdown.

8.4. Environmental Activism

At the start of this process of this thesis, environmental activism focussed specifically on climate change was not particularly mainstream within the United Kingdom. This was demonstrated in Appendix AD, for which less than five per cent of the respondents from the first survey stated that they were members of an environmental organisation in 2017. Initially, environmental activism was not being considered as a key ingredient of this PhD thesis.

However, since the prominence of Greta Thunberg and Extinction Rebellion in late 2018, environmental activism had rapidly grown as a form of response within both the United Kingdom and around the world. Consequently, it became a driver of climate change intervention in terms of bringing attention to the public as to the issue via the media, which was likely to have an impact on public perception and engagement of the issue.

Therefore, this thesis included an exploration of responses to the following question:

> *"Why do UK youth and other parts of society become supportive of environmental activism? And, in what way are UK youth and other parts of society likely to continue to participate in environmental activism?"*

In looking to the root causes of these protests, it can be noted that in the United Kingdom, as in many countries, addressing climate change has been mostly a top-down approach, with little engagement of the public. However, as demonstrated in Chapter 7, there was growing public dissatisfaction with the lack of action being taken by the government regarding legislation on causes of climate change. This occurred against a backdrop of warnings coming from the scientific community, IPCC and images of extreme weather on television, and a lack of voice for civil society.

The policy environment demonstrated a distinct lack of a post-normal science that would appeal and engage more widely. Activism observed in 2019 is arguably an act of post-normal engagement, which is when the civil society feels that the top-down approach is not working and want their voice to be heard on how to bring about change. It is arguable that changes to the Climate Change Act of 2008 during May 2019 became one of the first signs that the top-down approach is being reconsidered. Since then, a climate change assembly has been formed with its recommendations being presented to parliament on what the government should be doing in its bid to tackle climate change.

It remains to be seen if this activism for step changes is going to continue in the future in the post-COVID-19 pandemic era. There are signs that activism is likely to continue for many years to come, as demonstrated with the protest in London in September 2020, despite the COVID-19 pandemic restrictions still being in place. This theme of what next for activism groups is reflected upon further in Section 8.8.1.

8.5. Extreme Meteorological Events and Climate Change Perception

Whilst extreme meteorological events were not core to the new knowledge provided in this thesis, Chapter 5.4 has demonstrated there is a growing perception during heatwaves [2019] experienced within the United Kingdom being the result of climate change. This builds upon the results that suggest the majority of the public believe that climate change is already having an impact. However, the results suggest that the public are also being short-slighted regards the probable impact. The February/March 2019 heatwave was seen as context for every impact, but the proportion of those believing that this impact was occurring dropped significantly the following intervening year, whereas flooding rose as the prime impact. What occurred during these two time periods was that in 2019 the United Kingdom came out of a very unusual winter heatwave, when temperatures reached 21.2°C in Cambridge in February, whereas, one year later, the United Kingdom had just come out of one of the wettest winters, with widespread flooding impacts on large areas of Southern England and Wales. Changing public understanding of these events is explained in part by Radvansky and Zacks (2011) who stated that the public build their beliefs in real time depending on local and national events.

8.6. Revisiting the Conceptual Framework

The findings of this thesis across its five research questions broadly support the updated conceptual framework shown in Figure 8.1, though strengths of the relationships between elements can now be commented on further. For example, as demonstrated within Section 5.3 and 8.1.1, the results do not seem to confirm that certain worldviews have a significant impact of an individual's perception of climate change within the United Kingdom beyond the influence of social status and age.

However, the analysis suggests that there are additional factors that previously were not considered within the conceptual framework. The first is how household incomes impact on levels of engagement with climate change. The results throughout Chapter Five have demonstrated that those with a higher social status grading, in the vast majority of cases higher earners, are more concerned about and aware of climate change compared to those with a lower social status. However, Chapter Six demonstrated that engagement through mitigation, that requires behavioural changes, is not impacted by household incomes, with the largest factor in the undertaking of these mitigation strategies being the individual's perception of climate change. This is because, mitigation strategies that require a significant financial investment have a low uptake, as demonstrated within Table 6.2. This is especially so amongst the youngest within society. This is a consequence of the fact that young people generally tend to have a lower income compared to other age groups. In addition, household income does not just directly affect perception [Tables 5.7, 5.12, and 5.14] and engagement [Table 6.2] with climate change in terms of mitigating against climate change, but also increases their vulnerability and exposure to climate change associated disaster events. This route to the impact of extreme meteorological events has been observed previously, during the Hurricane Katrina impact on New Orleans (Elliott and Pais, 2006; Sharkey, 2007). Within a United Kingdom context, flooding is the most frequent extreme meteorological event. Further, research by Sayers, Penning-Rowsell and Horritt (2018) found that whilst most householders have some form of insurance, only 85 per cent of the poorest 10 per cent of householders have insurance compared to the national average of 93 per cent. When further exploring content insurance, less than half of the poorest 10 per cent have this form of insurance, and even less so amongst tenants. It is arguable that this is also then a demonstration of the poorest within society not having financial capital for insurance to help with the "bounce back" from the event, let alone the ability of individuals to have the capacity to "bounce forward" from the potential disaster. This is likely to be increasingly important in the face of the changing magnitude and frequency of meteorological disasters within the United Kingdom, especially flooding.

Lastly, there is an inclusion of an emphasised link (red line in Figure 8.1) between "reaction and response to risk" and "climate policy". This refers, in part to the 'post-normal engagement' which is explored in Sections 7.2 and 7.3. Whilst there is a connection between "reaction and response to risk" and "climate policy", via the medium of "engagement", this thesis has demonstrated that activism is due to the perceived lack of engagement/action of government and corporate industry within the United Kingdom and globally. This is emphasising that the public have a greater say and that increased action is critical in combatting climate change at both a national and international level. Whilst there is no direct link between climate activism (in terms of school strikes and Extinction Rebellion) and Theresa May government's changes to the Climate Change Act 2008, a causative link between the two cannot be ruled out. It is concluded that this is a likely sign that the United Kingdom is gradually changing to a more bottom-up approach to climate change policy and action.

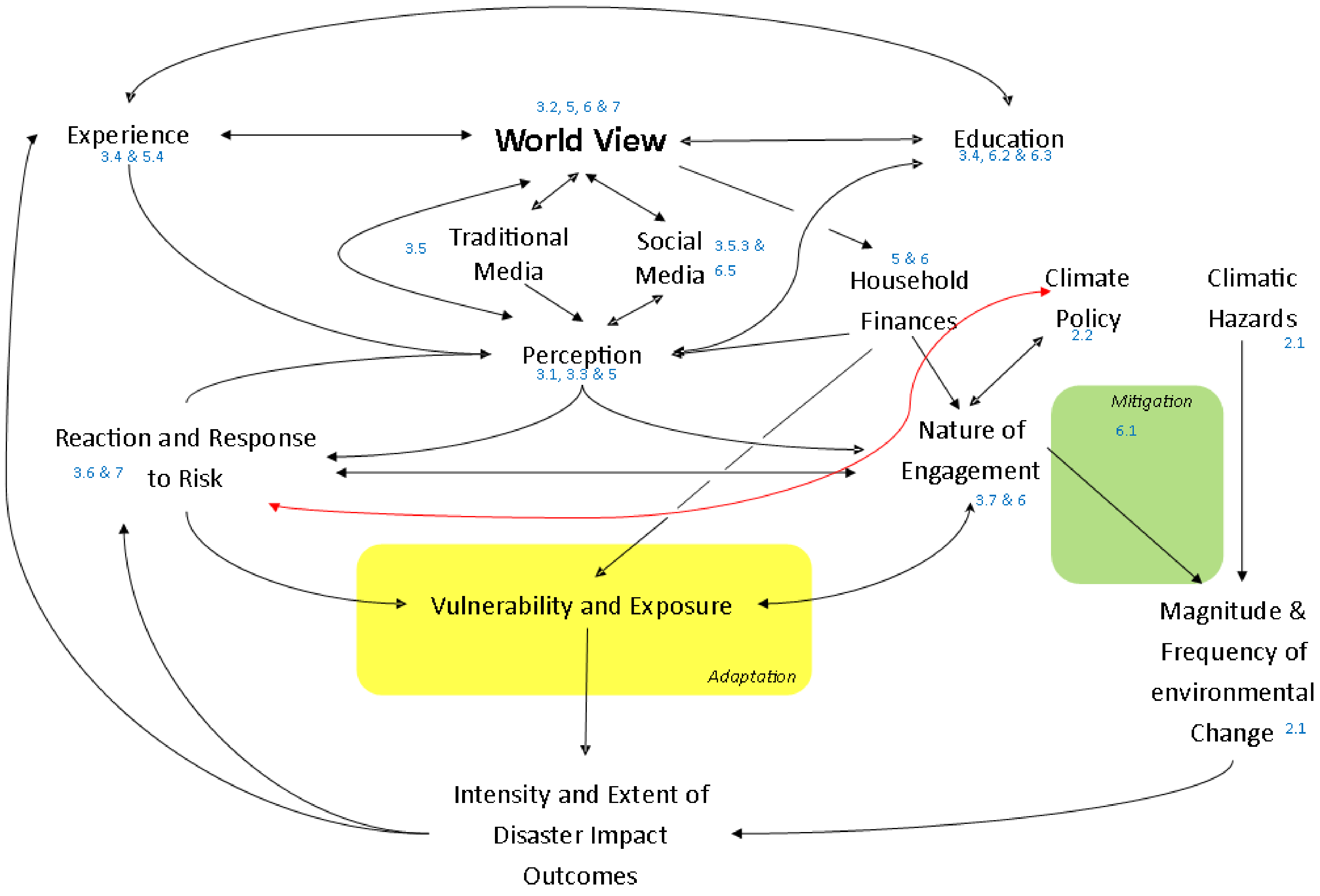

Figure 8.1 – Updated Conceptual Framework. (Source: Author)

Note: Numbers in the Figure link to related sections within this thesis

8.7. Limitations of Study and Recommendations

All research has limitations, and what follows is a reflexive comment at the close of this thesis.

Firstly, the questionnaire surveys were mostly distributed via social media and targeted emails, to reach areas and groups. A single researcher undertaking a national study would find it too difficult in terms of labour intensiveness and cost to reach the full sampling scope.

Consequently, the researcher had restricted control over who completed the surveys, this resulted in a self-selection bias within the results, with the implication that the results might not be fully balance in terms of social demographics. Having climate change in both the title and study rationale may have led to a greater tendency for climate-aware individuals to complete the surveys. Efforts were undertaken to reduce this impact through the usage of secondary comparative data, such as the BEIS and Eurobarometer datasets. In addition, people who do not use social media were significantly less likely to find the survey to complete, resulting in a section of the population being in effect excluded. During the first survey, attempts were made to offset this through use of a paper survey, though the limited resources led to only a much more limited number of respondents using that method. Even if not entirely representative of the population as a whole, this experience serves to inform us in a new way about the perception, engagement and reaction of a large group of individuals within the United Kingdom and the Crown Dependencies.

In addition, to reduce the issue of sample size bias in both surveys, a large sample was conducted. For example, the first survey had 1,134 respondents and the second survey had 1,700 respondents. As with any other study, the aim of his study was to reduce the margin of error within the data to between 2% and 3%. The main reason why the second study had a much larger sample was due to the new type of data that this survey was researching, meaning that there were no other studies for comparative purposes. Despite these large sample sizes, there were socio-economic biases, for example an under representation of BAME groups. Consequently, it was even more important to use secondary studies for comparative reasons.

A further limitation may be with regards to narrowness of research findings. When starting out this thesis, it aimed at looking at a deliberately broad spectrum of issues relating to climate change perception and engagement; however, due to limitation in the word count, a number of themes were not explored further in the write up. Whilst representing themes important to the issue of climate change, they were considered fewer integral elements of the findings and thesis developed. Results related to these elements left out can be found in Appendix S and will be drawn up within other publications. In this sense the thesis has prioritised depth over breadth.

Lastly, the sample size for the Yonmenkaigi System Method is relatively small, with only one study with 16 students. There were two main purposes for such a small study size. Firstly, the Yonmenkaigi System Method was only planned to be a demonstration of how participatory education could benefit understanding of climate change amongst young people; It was not intended to be a major focal point of this study, albeit it is acknowledged there is considerable interest in it. Secondly, as an independent researcher, there are limited resources available to implement multiple case examples; it was not possible to spare further finance and time to both plan and execute another Yonmenkaigi System Method set of exercises. However, relationships observed between some indicators from the Yonmenkaigi questionnaire suggest that there was indeed transformation of perception amongst the respondents of that study. It is recommended that studies into the Yonmenkaigi System Method should continue and be expanded out into a wider range of students.

8.8. Looking Forward on Direction of Climate Change Action

Due to the ever-changing nature of climate change threats, the direction of climate change related research within the social sciences will also be ever changing. It is important that within the United Kingdom, climate change perception tracking should be regularly undertaken, such as through application of the BEIS datasets to this purpose, and as undertaken by 'Yale Program on Climate Change Communication' within the United States. However, unlike the studies within the United States, once surveys have been carried out, limited levels of analyses have been undertaken, with a basic analysis being undertaken by the BEIS department in a summary document. This dataset has the potential of being used in an informative research driven way in the future to keep track of the United Kingdom civil society's perception of climate change.

Within recent years, there was a growing lacuna of action being undertaken by the government, in which climate activism groups of both 'Extinction Rebellion' and the 'School Strikes for Climate Change' materialised. It is arguable that these groups are a form of 'post-normal engagement' which only rose due to the lack of 'post-normal science' within the United Kingdom in response of climate change. As highlighted throughout Chapter 7, there was an overall level of support for the philosophy of the groups, despite there been less support for the actions being undertaken, especially by Extinction Rebellion. It is highly likely that once the main brunt of the COVID-19 pandemic has passed, both Extinction Rebellion and the School Strikes for Climate Change' are probably going to return to protesting on the streets again. Consequently, the monitoring of the demographic composition of these protests in terms of perception and differing engagement drives will help assess the nature of reactions towards future climate policy. This is especially important to that associated with the content of the COP26 which is being hosted in Glasgow, Scotland in November 2021.

8.8.1. COVID-19 and Climate Change

During the late stages of writing this thesis, the COVID-19 pandemic has fundamentally changed the way in which society can operate. As countries and groups of people around the world recover from the impacts of the COVID-19 pandemic, both socially and financially, analysis of the pandemic's impact on climate change perception and engagement warrants detailed attention. For example, societal perception of climate change, in terms of its seriousness and urgency, declined due to the COVID-19 pandemic, as postulated by the theory of 'finite pool of worry'. Currently, it is too early to tell what the impacts of the pandemic are on longer-term public perception, as it will take probably a year or two to fully observe the changes in societal perception of climate change in relation to pandemic impact.

However, it is already clear that there is a direct impact via changes in usage of public transportation. As highlighted in Section 6.1.3, there had already been some decline in the usage of public transportation in recent years, especially buses, but not accentuated. The COVID-19 pandemic has highlighted the vulnerability and susceptibility of the public to contracting colds, influenza and other infectious viruses, which is leading to more people driving in their own personal transportation [maintaining a personal bubble]. As societies within both the United Kingdom and around the world recover the COVID-19 pandemic, it is likely that public transportation will take much longer to recover its usage numbers. It will also take the companies and authorities a much greater effort to ensure the safety of passengers who use public transportation. Demand for public transport may be offset by changing work patterns with and an increased realisation of the feasibility of working from home, resulting in fewer emissions from office blocks and the commute to and from work.

In conclusion, the COVID-19 pandemic will impact climate change perception and engagement, but questions will remain as to how similar the COVID-19 pandemic [and potentially other pandemic] impacts are with climate change in the socio-engagement framing of this thesis. Despite looking different on the outside, the COVID-19 pandemic and climate change share similarities. The main way to examine the similarities is to examine how both climate change and the COVID-19 pandemic disruptions have been approached by the population using the three pillars of this thesis [perception, engagement and reaction].

In terms of getting the public to engage with the measures to mitigate against contracting the SARS-CoV-2 virus [such as physical distancing[54], wearing of facemasks and regularly washing hands], a high level of belief of the threat of the virus [perception] has been needed. This sheds light on, or mirrors, the thought processes that are needed to undertake engagement with climate change. The reaction and response are different in the case of the COVID-19 pandemic in terms of demanding more action to protect the population from the virus [as most people will not protest due to the risks], but they can undertake this outpouring of belief in other ways, such as through social media. This has been observed for the case of climate change in recent months with the school strike for climate change, who instead of protesting on the streets, protest on social media by flooding social media feeds with images and messages about the risks and dangers of climate change, with a demand for action here and now (Murray, 2020).

A difference between COVID-19 and climate change perception, engagement and reaction is in the speed of interventions by governments, academia and the general public both within the United Kingdom and by most countries around the world. COVID-19 was first discovered in December 2019 and roughly a month later the first lockdown of the public took place in Wuhan, China, and by the end of March 2020, there were lockdowns in place for the majority of the world citizens. These decisive actions undertaken by governments, came with a great financial cost (Chan, 2020), but were generally publicly accepted (Wright, 2020; YouGov, 2020).

When reaction to COVID-19 is compared to the government action on climate change, engagement is very slow with governments globally having been discussing how to respond to the threat of climate change since the 1980s. Despite this, the COVID-19 pandemic has raised one point in that respect that could already be viewed as a lesson. Societies which have been slow to prepare and put in place actions to reduce COVID-19, had to place their populations into greater lockdown resulting in greater economic damage and more prolonged disruption and ill-being. This was the case for the United Kingdom (Harnett, 2020). It is arguable that there are parallels to climate change thought the need for greater preparedness to reduce inevitable impacts. It has long been argued that the longer it takes to enforce action to combat and prepare for climate change, the greater the action that will be needed later, and if neglected the impacts will be much worse, as had been earlier suggested within the Stern Review.

[54] - Commonly referred to in the media and everyday conversation as ‘social distancing’.

Appendices

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Appendix A – Climate Public Perception Overview within the United Kingdom

Table A.1 – Papers that examine public perception of climate change, climate activism, mitigation and adaption within the United Kingdom

Authors	**Title**	**Geographic Focus**	**Method**	**Sample Size**
Abrahamson *et al.* (2009)	"Perceptions of heatwave risks to health: interview-based study of older people in London and Norwich, UK"	London Norwich (Norfolk)	Interview	*N* = 73
Bellamy and Hulme (2011)	"Beyond the Tipping Point: Understand Perceptions of Abrupt Climate Change and Their Implications"	East Anglia	Survey Focus Group	*N* = 287 *N* = 15
Bertoldo *et al.* (2019)	"Scientific truth or debate: On the link between perceived scientific consensus and belief in anthropogenic climate change"	France Germany Norway United Kingdom	Survey	*N* = 1,010 *N* = 1,001 *N* = 1,004 *N* = 1,033
Bichard and Kazmierczak (2012)	"Are homeowners willing to adapt to and mitigate the effects of climate change?"	England and Wales	Survey	*N* = 961
Bradford *et al.* (2012)	"Risk perception – issues for flood management in Europe"	Europe	Survey	*N* = 1,375
Burningham, Fielding and Thrush (2008)	"'It'll never happen to me': understand public awareness of local flood risk"	England and Wales	Survey Focus Groups Interviews	*N* > 1,000 N = ? N = ?

Table A.1 – Papers that examine public perception of climate change, climate activism, mitigation and adaption within the United Kingdom (Continued)

Authors	**Title**	**Geographic Focus**	**Method**	**Sample Size**
Butler and Pidgeon (2011)	"From `flood defence' to `flood risk management': exploring governance, responsibility, and blame"	Gloucester (Gloucestershire) Oxford (Oxfordshire) Sheffield (South Yorkshire)	Focus Group Interview 3x Survey	*N* = 50 *N* = 45 *N* = 1,000 *N* = 2,850 *N* = 3,393
Capstick *et al.* (2015)	"Public perception of climate change in Britain following the winter 2013/2014 flooding"	United Kingdom	2x Survey	*N* = 1,002 *N* = 995
Capstick and Pidgeon (2014b)	"What is climate change scepticism? Examination of the concept using a mixed methods study of the UK public"	United Kingdom	Interview Survey	*N* = 47 *N* = 500
Corner *et al.* (2011)	"Nuclear power, climate change and energy security: Exploring British public attitudes"	United Kingdom	Survey	*N* = 1,822
Corner *et al.* (2020)	"Engaging the public on climate risk and adaptation: A briefing for UK communicators"	United Kingdom	Survey	*N* = 1,400
Costa-Font, Mossialos and Rudisill (2009)	"Optimism and the perceptions of new risk"	United Kingdom	Survey	*N* = 1,547
Demski, Spence and Pidgeon (2013)	"Transforming the UK Energy System: Public Values, Attitudes and Acceptability: Summary findings from a survey conducted August 2012"	United Kingdom	Survey	*N* = 2,441

Table A.1 – Papers that examine public perception of climate change, climate activism, mitigation and adaption within the United Kingdom (Continued)

Authors	Title	Geographic Focus	Method	Sample Size
Dessai and Sims (2010)	"Public perception of drought and climate change in southeast England"	South East England	Focus Group Survey	*N* = 14 *N* = 102
Doran *et al.* (2019)	"Consequence evaluations and moral concerns about climate change: insights from nationally representative surveys across four European countries"	France Germany Norway United Kingdom	Survey	*N* = 1,010 *N* = 1,001 *N* = 1,004 *N* = 1,033
Few, Brown and Tompkins (2007)	"Public participation and climate change adaptation: Avoiding the illusion of inclusion"	Christchurch Bay (Dorset) Orkney Islands	Interview Participatory Workshop	*N* = ? *N* = ?
Fielding (2012)	"Inequalities in exposure and awareness of flood risk in England and Wales"	England and Wales	Survey	*N* = 1034
Fischer *et al.* (2012)	"Climate Change? No, Wise Resource Use is the Issue: Social Representation of Energy, Climate Change and the Future"	Europe	Interview	*N* = 202
Glenk and Fischer (2010)	"Insurance, prevention or just wait and see? Public preference for water management strategies in the context of climate change"	Scotland	Survey	*N* = 1,033
Harries (2008)	"Feeling secure or being secure? Why it can seem better not to protect yourself against a natural hazard"	United Kingdom	Focus Group Interviews	*N* = 40

Table A.1 – Papers that examine public perception of climate change, climate activism, mitigation and adaption within the United Kingdom (Continued)

Authors	**Title**	**Geographic Focus**	**Method**	**Sample Size**
Harries (2012)	"The anticipated emotional consequences of adaptive behaviour-impacts on the take-up of household flood-protection measures"	England	Survey	*N* = 555
Harris and Corner (2011)	"Communicating Environmental Risks: Clarifying the Severity Effect in Interpretations of Verbal Probability Expressions'	England and Wales	3x Experiment	*N* = 101 *N* = 83 *N* = 191
Harvatt, Petts and Chilvers (2011)	"Understanding householders responses to natural hazards: flooding and sea-level rise comparisons"	Aldeburg (Suffolk) Barnstaple (Devon) Truro (Cornwall)	Interview Survey	*N* = 35 *N* = 77
Howell (2011)	"Lights, camera … action? Altered attitudes and behaviour in response to the climate change film The Age of Stupid"	Edinburgh	2x Survey	*N* = 212 *N* = 162
Howgate and Kenyon (2009)	"Community cooperation with natural flood management: a case study in the Scottish Borders"	Borthwick Water Valley (Scottish Borders)	Case Study/Survey	*N* = 30
Lamond, Proverbs and Hammond (2009)	"Accessibility of flood risk insurance in the UK: confusion, competition and complacency"	United Kingdom	Survey	*N* = 403

Table A.1 – Papers that examine public perception of climate change, climate activism, mitigation and adaption within the United Kingdom (Continued)

Authors	**Title**	**Geographic Focus**	**Method**	**Sample Size**
Lorenzoni et al. (2006)	"Cross-national comparison of image associations with "global warming" and "climate change" among laypeople in the United States of America and Great Britain"	United Kingdom United States	Survey UK Survey USA	*N* = 316 *N* = 673
Lorenzoni, Nicholson-Cole and Whitmarsh (2007)	"Barriers perceived to engaging with climate change among the UK public and their policy implications"	United Kingdom	Focus Group Survey	*N* = ? *N* = 200
Lorenzoni and Pidgeon (2006)	"Public views on climate change: European and USA perspectives"	Europe and United Kingdom	Survey (Secondary)	Multiple old Survey
Lowe *et al.* (2006)	"Does tomorrow ever come? Disaster narrative and public perception of climate change"	Norwich (Norfolk)	Focus Group Survey	*N* = ? *N* = 301
McCright, Dunlap and Marquart-Pyatt (2016)	"Political ideology and views about climate change in the European Union"	European Union	Survey	*N* = 25,150
Morton *et al.* (2011)	"The future that may (or may not) come: How framing change responses to uncertainty in climate change communication"	United Kingdom	2x Experiment	*N* = 88 *N* = 120
Niemeyer, Petts and Hobson (2005)	"Rapid climate change and society: Assessing responses and thresholds"	West Midlands	Interview	*N* = 29

Table A.1 – Papers that examine public perception of climate change, climate activism, mitigation and adaption within the United Kingdom (Continued)

Authors	**Title**	**Geographic Focus**	**Method**	**Sample Size**
O'Neill and Nicholson-Cole (2009)	""Fear Won't Do It" Promoting Positive Engagement With Climate Change Through Visual and Iconic Representations"	United Kingdom	Focus Group Interview Survey	*N* = 27 *N* = 30 *N* = 63
Palutikof, Agnew and Hoar (2004)	"Public perception of unusually warm weather in the UK: impacts, responses and adaptations"	Scotland South of England	Survey	*N* = 295
Parker, Priest and McCarthy (2011)	"Surface water flood warning requirements and potential in England and Wales"	Rotherham (South Yorkshire) Wealdstone Brook (Greater London)	2x Focus Groups	*N* = 33 *N* = 31
Parker, Tapsell and McCarthy (2007)	"Enhancing the human benefits of flood warnings. Natural Hazards"	England and Wales	Mixed (Secondary)	Multiple Old Surveys and Interviews
Partridge *et al.* (2017)	"Seeing futures now: Emergent US and UK views on shale development, climate change and energy systems"	London and Cardiff (United Kingdom) Los Angeles and Santa Barbara (United States)	4x Workshop	*N* = 55
Pidgeon, Lorenzoni and Poortinga (2008)	"Climate change or nuclear power – No thanks!"	United Kingdom	Survey (Secondary)	Multiple Old Surveys

Table A.1 – Papers that examine public perception of climate change, climate activism, mitigation and adaption within the United Kingdom (Continued)

Authors	Title	Geographic Focus	Method	Sample Size
Poortinga, Pidgeon and Lorenzoni (2006)	"Public Perceptions Of Nuclear Power, Climate Change And Energy Options In Britain: Summary Findings Of A Survey Conducted During October and November 2005"	United Kingdom	Survey	*N* = 1,491
Poortinga *et al.* (2003)	"Public Perception of Risk, Science and Governance: Main findings of a British survey of five risk cases"	United Kingdom	Survey	*N* = 1,547
Poortinga *et al.* (2011)	"Uncertain climate: An investigation into public scepticism about anthropogenic climate change"	United Kingdom	Survey	*N* = 1,822
Poortinga *et al.* (2013)	"Public Attitudes to Nuclear Power and Climate Change I Britain Two Years after the Fukushima Accident"	United Kingdom	Survey	*N* = 961
Poortinga *et al.* (2019)	"Climate change perception and their individual-level determinants: A cross-European analysis"	United Kingdom and 22 European Countries (including Iceland, Israel and Russia)	Survey (UK) Survey (Others) (Secondary)	*N* = 1,959 *N* = 44,387
Rabinovich and Morton (2012)	"Unquestioned answers or unanswered questions: beliefs about science guide responses to uncertainty in climate change risk communication"	United Kingdom and Worldwide	2x Experiment	*N* = 108 *N* = 106

Table A.1 – Papers that examine public perception of climate change, climate activism, mitigation and adaption within the United Kingdom (Continued)

Authors	**Title**	**Geographic Focus**	**Method**	**Sample Size**
Rundblad, Knapton, and Hunter (2010)	"Communication, perception and behaviour during a natural disaster involving a 'Do Not Drink' and a subsequent 'Boil Water' notice: a postal questionnaire study"	Gloucestershire	Survey	*N* = 195
Sharples (2010)	"Communicating Climate Science: Evaluating the UK Public's Attitude to Climate Change"	United Kingdom	2x Survey	*N* = 109 *N* = 61
Shuckburgh, Robison and Pidgeon (2012)	"Climate Science, the Public and the News Media"	United Kingdom	Survey 6x Focus Groups	*N* = 2,000 *N* = 48
Soane *et al.* (2010)	"Flood perception and mitigation: the role of severity, agency, and experience in the purchase of flood protection, and the communication of flood information"	United Kingdom	Survey	*N* = 1,732
Spence and Pidgeon (2010)	"Framing and communicating climate change: The effects of distance and outcome frame manipulations"	United Kingdom	Experiment	*N* = 161
Spence *et al.* (2011)	"Perceptions of climate change and willingness to save energy related to flood experience"	United Kingdom	Survey	*N* = 1,822
Spence, Poortinga and Pidgeon (2012)	"The Psychological Distance of Climate Change"	United Kingdom	Survey	*N* = 1,822

Table A.1 – Papers that examine public perception of climate change, climate activism, mitigation and adaption within the United Kingdom (Continued)

Authors	**Title**	**Geographic Focus**	**Method**	**Sample Size**
Steentjes *et al.* (2017)	"European Perception of Climate Change (EPCC): Topline finding of a survey conducted in four European countries in 2016"	France Germany Norway United Kingdom	Survey	N = 1,010 N = 1,001 N = 1,004 N = 1,033
Thomas *et al.* (2018)	"The impact of parenthood on environmental attitudes and behaviour: a longitudinal investigation of the legacy hypothesis"	United Kingdom	Survey	N = 18,176
van der Linden (2015)	"The social-psychological determinants of climate change risk perceptions: Towards a comprehensive model"	United Kingdom	Survey	N = 808
Whitmarsh (2008)	"Are flood victims more concerned about climate change than other people? The role of direct experience in risk perception and behavioural response"	South of England	Interview Survey	N = 24 N = 589
Whitmarsh (2009)	"What's in a name? Commonalities and differences in public understanding of "climate change" and "global warming""	South of England	Survey	N = 589
Whitmarsh (2011)	"Scepticism and uncertainty about climate change: Dimensions, determinants and change over time"	Hampshire Hampshire and Norfolk	Survey Survey	N = 589 N = 551

Table A.1 – Papers that examine public perception of climate change, climate activism, mitigation and adaption within the United Kingdom (Continued)

Authors	Title	Geographic Focus	Method	Sample Size
Whitmarsh and Corner (2017)	"Tools for a new climate conversation: A mixed-methods study of language for public engagement across the political spectrum"	United Kingdom	Mixed	*N* = 2,088
Whitmarsh, Seyfang and O'Neill (2011)	"Public engagement with carbon and climate change: To what extent is the public 'carbon capable'?"	Hampshire and Norfolk	Survey	*N* = 551
Whitmarsh, Xenias and Jones (2019)	"Framing effects on public support for carbon capture and storage"	Canada Netherlands Norway United Kingdom United States	Survey	*N* = 5,406
Wolf, Adger and Lorenzoni (2010)	"Heat waves and cold spells: an analysis of policy response and perceptions of vulnerable populations in the UK"	Norwich (Norfolk)	Interview	*N* = 15
Wolf *et al.* (2010)	"Social capital, individual responses to heat waves and climate change adaption: An empirical study of two UK cities"	London Norwich (Norfolk)	Interview	*N* = 105

Source: Adapted and Updated from Taylor, Dessai and Bruine de Bruin, 2014; Capstick *et al.*, 2015

Appendix B – Climate Public Perception Overview outside the United Kingdom

Table B.1 – Papers that examine public perception of climate change, climate activism, mitigation and adaption outside the United Kingdom

Authors	Title	Geographic Focus	Method	Sample Size
Aitken, Chapman and McClure (2011)	"Climate change, powerlessness and the commons dilemma: Assessing New Zealanders' preparedness to act"	New Zealand	Survey	*N* = 192
Akter and Bennett (2011)	"Household perception of climate change and preferences for mitigation action: The case of the Carbon Pollution Reduction Scheme in Australia"	Australia	Survey	*N* = 634
Arbuckle Jr., Morton and Hobbs (2013)	"Farmer beliefs and concerns about climate change and attitudes towards adaptation and mitigation: Evidence from Iowa"	Iowa (United States)	Survey	*N* = 1,276
Arbuckle Jr. *et al.* (2013)	"Climate change beliefs, concerns, and attitudes towards among farmers in the Midwestern United States"	Mid-West (United States)	Survey	*N* = 4,778
Bostrom *et al.* (2012)	"Causal thinking and support for climate change policies: International survey findings"	Austria Bangladesh Finland Germany Norway	Survey	*N* = 286 *N* = 25 *N* = 19 *N* = 145 *N* = 171
Braun *et al.* (2018)	"Public perception of climate engineering and carbon capture and storage in Germany: survey evidence"	Germany	Survey	*N* = 3,526

Table B.1 – Papers that examine public perception of climate change, climate activism, mitigation and adaption outside the United Kingdom (Continued)

Authors	**Title**	**Geographic Focus**	**Method**	**Sample Size**
Connor and Higginbotham (2013)	""Natural cycles" in lay understandings of climate change"	Hunter Valley (Australia)	Survey Interview	*N* = 1,162 *N* = 467
Demski *et al.* (2018)	"National context is a key determinant of energy security concerns across Europe"	Europe	Survey (Secondary)	*N* = 44,387[55]
Douenne and Fabre (2020)	"French attitudes on climate change, carbon taxation and other climate policies"	France	Survey	*N* = 3,002
Gustafson *et al.* (2020b)	"Climate Change in the Minds of U.S. News Audiences"	United States	3x Survey	*N* = 3,623
Leiserowitz, Smith and Marlon (2011)	"American Teens' Knowledge of Climate Change"	United States	Survey	*N* = 2,030
Leiserowitz *et al.* (2013)	"Extreme Weather and Climate Changes in the American Mind: April 2013"	United States	Survey	*N* = 1,045
Leiserowitz *et al.* (2014)	"Climate Change in the American Mind: October 2014"	United States	Survey	*N* = 1,275

[55] - The sample sizes for each of the countries are: Austria = 2,010; Belgium = 1,766; Czech Republic = 2,269; Estonia = 2,019; Finland = 1,925; France = 2,070; Germany = 2,852; Hungary = 1,614; Iceland = 880; Ireland = 2,757; Israel = 2,557; Italy = 2,626; Lithuania = 2,122; Netherlands = 1,681; Norway = 1,545; Poland = 1,694; Russia = 2,430; Slovenia = 1,307; Spain = 1,958; Sweden = 1,551; Switzerland = 1,525; United Kingdom = 1,959.

Table B.1 – Papers that examine public perception of climate change, climate activism, mitigation and adaption outside the United Kingdom (Continued)

Leiserowitz *et al.* (2018)	"Politics & Global Warming, March 2018"	United States	Survey	*N* = 1,067
Leiserowitz *et al.* (2019a)	"Climate Change in the American Mind: April 2019"	United States	Survey	*N* = 1,291
Maibach *et al.* (2016)	"Is there a climate "spiral of silence" in America: March, 2016"	United States	Survey	*N* = 1,204
Mildenberger *et al.* (2016)	"The Distribution of Climate Change Opinion in Canada"	Canada	4x Survey (Secondary)	*N* = 1,214 (2011) *N* = 1,502 (2013) *N* = 1,401 (2014) *N* = 1,014 (2015)
Nisbet (2009)	"Communicating Climate Change: Why Frames Matter for Public Engagement"	United States	Survey (Secondary)	Multiple old Surveys
Nisbet and Myers (2007)	"Trends: Twenty Years of Public Opinion about Global Warming"	United States	Survey (Secondary)	Multiple old Surveys
Pietsch and McAllister (2010)	"'A diabolical challenge': public opinion and climate change policy in Australia"	Australia	Survey (Secondary)	Multiple old Surveys
Shi, Visschers and Siegrist (2015)	"Public Perception of Climate Change: The Importance of Knowledge and Cultural Worldviews"	Switzerland	Survey	*N* = 1,065

Table B.1 – Papers that examine public perception of climate change, climate activism, mitigation and adaption outside the United Kingdom (Continued)

Tranter and Booth (2015)	"Scepticism in a changing climate: A cross-national study"	Various	Survey (Secondary)	*N* = 19,991[56]
Visschers (2018)	"Public Perception of Uncertainties Within Climate Change Science"	Switzerland	Survey	*N* = 306

[56] - The sample sizes for each of the countries are: Australia = 1,946; Austria = 1,019; Canada = 985; Denmark = 1,305; Finland = 1,211; France = 2,253; Germany = 1,407; Great Britain = 928; New Zealand = 1,172; Norway = 1,382; Spain = 2;560; Sweden = 1,181; Switzerland = 1,212; United States = 1,430.

Appendix C – Percentage of the British Public that believe the World's Climate is changing

Table C.1 - Percentage of the British Public between 2005 and 2019 that believe the World's Climate is changing

Date of Study	Yes	No	Don't Know	Source
November 2005	91%	4%	5%	Poortinga *et al.* (2006)
November 2009	83%	15%	2%	BBC (2010)
January-March 2010	78%	15%	6%	Spence *et al.* (2010)
March 2011	80%	13%	7%	Shuckburgh, Robison and Pidegon (2012)
August 2012	79%	11%	11%	Demski, Spense and Pidgeon (2013)
March 2013	72%	19%	9%	Poortinga *et al.* (2013)
October 2014	88%	6%	6%	Chapstick *et al.* (2015)
June 2016	86%	12%	2%	Steentjes *et al.* (2017)
February-September 2017	95.6%	1.3%	3.1%	Author [This Thesis]
May-July 2019	98.47%	0.59%	0.94%	Author [This Thesis]

Note: All Percentages might not add up to 100 per cent due to rounding errors

Source: Author

Appendix D – Eurobarometer Data on Climate Change

Table D.1 – Overview Details of the Eurobarometer Surveys

Year	Survey Number	Survey Date	UK Survey Size	
			Overall	15-24
2008	Standard 300	25th March – 4th May	646	N/A
2009	Special 322	August – September	1,306	210 (16.1%)
2011	Special 372	4th June – 19th June	1,342	214 (15.9%)
2013	Special 408	23th November – 2nd December	1,331	210 (15.8%)
2015	Special 435	30th May – 8th June	1,306	206 (15.8%)
2017	Special 459	18th March – 27th March	1,347	209 (15.5%)
2019	Special 490	9th April – 26th April	1,052	164 (15.6%)

Question: Which of the following do you consider to be the single most serious problem facing the world as a whole?

Table D.2 – The British public's perception, between 2008 and 2019, of what is the most serious issue facing the world

	2008	2009	2011	2013	2015	2017	2019
Climate change / Global warming[57]	204 31.6%	231 17.4%	241 18.0%	161 12.1%	186 14.2%	190 14.1%	308 29.3%
Availability of energy	-	-	107 8.0%	-	-	-	-
International terrorism	151 23.4%	189 14.2%	219 16.3%	176 13.2%	360 27.6%	343 25.5%	176 16.7%
Poverty, lack of food and drinking water	126 19.5%	327 24.6%	271 20.2%	450 33.8%	391 29.9%	356 26.4%	256 24.3%
The spread of an infectious disease	20 3.1%	52 3.9%	29 2.2%	33 2.5%	35 2.7%	39 2.9%	10 1.0%
A major global economic downturn / The Economic Situation[58]	26 4.0%	207 15.6%	168 12.5%	151 11.3%	84 6.4%	49 3.6%	77 7.3%
The proliferation of nuclear weapons	10 1.5%	14 1.1%	37 2.8%	32 2.4%	16 1.2%	79 5.9%	37 3.5%
Armed conflicts	25 3.9%	86 6.5%	89 6.6%	92 6.9%	103 7.9%	104 7.7%	63 6.0%
The increasing world population	54 8.4%	163 12.2%	126 9.4%	183 13.7%	110 8.4%	122 9.1%	99 9.4%
Other (Specify)	1 0.2%	9 0.7%	2 0.1%	7 0.5%	6 0.5%	8 0.6%	2 0.2%
None	-	9 0.7%	-	8 0.6%	4 0.3%	18 1.3%	4 0.4%
Don't Know	29 4.5%	33 2.5%	53 3.9%	37 2.8%	12 0.9%	36 2.7%	20 1.9%

Source: Data Adapted from Eurobarometer (2008); Eurobarometer (2009); Eurobarometer (2011); Eurobarometer (2013); Eurobarometer (2015); Eurobarometer (2017); Eurobarometer (2019)

[57] - Known as 'Global Warming' in the 2008 survey only.
[58] - Change of wording from "A major global economic downturn" to "The Economic Situation" in the 2011 Eurobarometer.

Question: “And how serious a problem do you think climate change is at this moment? Please use a scale from 1 to 10, with '1' meaning it is "not at all a serious problem" and '10' meaning it is "an extremely serious problem".”

Table D.3 – Overall European public’s perception, in 2017, how serious a problem they think climate change is currently

No.	Country	*N*	1	2	3	4	5	6	7	8	9	10	Don’t Know	Average
1	Spain	1,023	5 0.5%	1 0.1%	10 1.0%	11 1.1%	48 4.7%	45 4.4%	179 17.5%	248 24.2%	151 14.7%	307 30.0%	18 1.8%	**8.21**
2	Greece	1,010	10 1.0%	3 0.3%	4 0.4%	9 0.9%	50 5.0%	68 6.7%	131 13.0%	252 25.0%	207 20.5%	273 27.0%	3 0.3%	**8.19**
3	Italy	1,022	7 0.7%	7 0.7%	8 0.8%	11 1.1%	38 3.7%	97 9.5%	159 15.6%	221 21.6%	139 13.6%	309 30.2%	26 2.5%	**8.12**
4	France	1,005	8 0.8%	4 0.4%	11 1.1%	11 1.1%	89 8.9%	81 8.1%	160 15.9%	164 16.3%	90 9.0%	376 37.5%	11 1.1%	**8.08**
	Hungary	1,052	3 0.3%	7 0.7%	12 1.1%	14 1.3%	68 6.5%	66 6.3%	184 17.5%	231 21.9%	137 13.0%	325 30.9%	5 0.5%	
6	Portugal	1,060	1 0.1%	0 0.0%	3 0.3%	13 1.2%	82 7.7%	66 6.2%	206 19.4%	251 23.7%	144 13.6%	277 26.1%	17 1.6%	**8.03**
7	Malta	497	4 0.8%	1 0.2%	9 1.8%	2 1.2%	42 8.4%	36 7.2%	62 12.4%	131 26.2%	55 11.0%	149 29.8%	6 1.2%	**8.00**
8	Sweden	1,006	11 1.1%	6 0.6%	13 1.3%	10 1.0%	61 6.1%	78 7.7%	189 18.8%	216 21.4%	100 9.9%	315 31.3%	7 0.7%	**7.98**
9	Cyprus	502	2 0.4%	3 0.6%	5 1.0%	11 2.2%	63 12.6%	27 5.4%	58 11.6%	106 21.2%	66 13.2%	153 30.5%	8 1.6%	**7.96**
10	Bulgaria	1,045	9 0.9%	6 0.6%	18 1.7%	21 2.0%	71 6.8%	99 9.5%	146 14.0%	184 17.6%	117 11.2%	302 28.9%	72 6.9%	**7.90**
11	Denmark	997	3 0.3%	7 0.7%	17 1.7%	27 2.7%	89 8.9%	76 7.6%	162 16.2%	214 21.4%	81 8.1%	319 31.9%	5 0.5%	**7.88**
12	Luxembourg	511	10 2.0%	4 0.8%	7 1.4%	7 1.4%	51 10.0%	40 7.8%	72 14.1%	95 18.6%	69 13.5%	151 29.6%	5 1.0%	**7.84**
13	Germany	1,537	36 2.3%	10 0.7%	43 2.8%	44 2.9%	138 9.0%	100 6.5%	203 13.2%	327 21.3%	155 10.1%	462 30.1%	19 1.2%	**7.71**

Table D.3 – European public's perception, in 2017, how serious a problem they think climate change is currently (Continued)

No.	Country	*N*	1	2	3	4	5	6	7	8	9	10	Don't Know	Average
14	Slovenia	1,027	21 2.0%	13 1.3%	22 2.1%	23 2.2%	126 12.3%	77 7.5%	132 12.9%	186 18.1%	97 9.4%	312 30.4%	18 1.8%	**7.63**
15	Lithuania	1,000	14 1.4%	8 0.8%	29 2.9%	28 2.8%	126 12.6%	83 8.3%	119 11.9%	169 16.9%	124 12.4%	289 28.9%	11 1.1%	**7.62**
	Romania	1,034	7 0.7%	4 0.4%	23 2.2%	44 4.3%	108 10.5%	133 12.9%	150 14.5%	143 13.8%	93 9.0%	309 29.9%	20 1.9%	
17	Netherlands	1,016	12 1.2%	4 0.4%	16 1.6%	21 2.1%	76 7.5%	90 8.9%	229 22.6%	265 26.1%	121 11.9%	175 17.2%	7 0.7%	**7.57**
18	Croatia	1,047	15 1.4%	14 1.3%	38 3.6%	52 5.0%	86 8.2%	97 9.3%	159 15.2%	170 16.2%	80 7.6%	321 30.6%	15 1.4%	**7.53**
19	Slovakia	1,012	8 0.8%	3 0.3%	9 0.9%	17 1.7%	122 12.0%	142 14.0%	167 16.5%	179 17.7%	119 11.7%	212 20.9%	34 3.4%	**7.51**
20	Belgium	1,024	4 0.4%	12 1.2%	32 3.1%	17 1.7%	91 8.9%	142 13.9%	193 18.9%	204 19.9%	100 9.8%	220 21.5%	9 0.9%	**7.48**
21	Finland	1,010	19 1.9%	10 1.0%	27 2.7%	25 2.5%	95 9.4%	81 8.0%	172 17.0%	249 24.6%	122 12.1%	204 20.4%	6 0.6%	**7.47**
22	Austria	1,000	8 0.8%	11 1.1%	29 2.9%	51 5.1%	85 8.5%	125 12.5%	179 17.9%	173 17.3%	103 10.3%	227 22.7%	9 0.9%	**7.39**
23	Ireland	1,020	8 0.8%	10 1.0%	26 2.5%	30 2.9%	125 12.2%	114 11.2%	189 18.5%	219 21.4%	91 8.9%	193 18.9%	15 1.5%	**7.32**
24	United Kingdom	1,347	44 3.3%	16 1.2%	37 2.7%	39 2.9%	159 11.8%	136 10.1%	214 15.9%	269 20.0%	111 8.2%	269 20.0%	53 3.9%	**7.19**
25	Poland	1,008	19 1.9%	7 0.7%	18 1.8%	50 5.0%	161 16.0%	106 10.5%	161 16.0%	194 19.2%	77 7.6%	155 15.4%	60 6.0%	**7.01**
26	Czech Republic	1,055	15 1.4%	13 1.2%	45 4.3%	54 5.1%	178 16.8%	132 12.7%	179 16.9%	165 15.6%	63 6.0%	198 18.7%	13 1.2%	**6.90**
27	Latvia	1,007	45 4.5%	26 2.6%	38 3.8%	41 4.1%	175 17.4%	129 12.8%	174 17.3%	150 14.9%	47 4.7%	162 16.1%	19 1.9%	**6.58**

Table D.3 – European public's perception, in 2017, how serious a problem they think climate change is currently (Continued)

No.	Country	*N*	1	2	3	4	5	6	7	8	9	10	Don't Know	Average
28	Estonia	1,015	50 4.9%	29 2.9%	47 4.6%	58 5.7%	199 19.6%	101 9.9%	176 173%	139 13.7%	42 4.1%	137 13.5%	37 3.6%	**6.30**
-	European Union (EU-28)	27,891	398 1.4%	239 0.9%	596 2.1%	741 2.7%	2,802 10.0%	2,567 9.2%	4,504 16.1%	5,514 19.8%	2,901 10.4%	7,101 25.5%	528 1.9%	**7.59**
-	European Union (EU-27)[59]	26,544	354 1.3%	223 0.8%	559 2.1%	702 2.6%	2,643 10.0%	2,431 9.2%	4,290 16.2%	5,245 19.8%	2,790 10.5%	6,832 25.7%	475 1.8%	**7.61**

No. = Number; *N* = Number of Respondents; Note: All Percentages might not add up to 100 per cent due to rounding errors

Source: Data Adapted from Eurobarometer (2017)

[59] - EU27 means all European Union countries in 2019 excluding the United Kingdom

Table D.4 – Overall European public's perception, in 2019, how serious a problem they think climate change is currently

No.		Country	*N*	1	2	3	4	5	6	7	8	9	10	Don't Know	Average	
↑ 6	**1**	Malta	505	1 0.2%	1 0.2%	2 0.4%	1 0.2%	6 1.2%	22 4.3%	44 8.7%	79 15.6%	86 17.0%	257 50.7%	6 1.2%	**8.90**	↑ 0.90
↓ 1	**2**	Spain	1,011	1 0.1%	6 0.6%	4 0.4%	17 1.7%	31 3.1%	46 4.5%	113 11.2%	208 20.6%	171 16.9%	405 40.1%	9 0.9%	**8.55**	↑ 0.34
↓ 1	**3**	Greece	1,014	1 0.1%	1 0.1%	11 1.1%	12 1.2%	36 3.6%	36 3.6%	103 10.2%	260 25.6%	221 21.8%	332 32.7%	1 0.1%	**8.48**	↑ 0.29
↑ 5	**4**	Cyprus	505	0 0.0%	2 0.4%	3 0.6%	11 2.2%	37 7.3%	29 5.8%	61 12.1%	94 18.7%	72 14.3%	192 38.1%	4 0.8%	**8.33**	↑ 0.37
↓ 1	**5**	Hungary	1,002	0 0.0%	6 0.6%	12 1.2%	9 0.9%	52 5.1%	61 6.0%	147 14.4%	201 19.6%	170 16.6%	355 34.7%	9 0.9%	**8.31**	↑ 0.23
=	**6**	Portugal	1,013	0 0.0%	0 0.0%	3 0.3%	13 1.3%	42 4.2%	67 6.6%	158 15.6%	251 24.8%	199 19.7%	273 27.0%	7 0.7%	**8.27**	↑ 0.24
↑ 4	**7**	Denmark	1,019	2 0.2%	6 0.6%	18 1.8%	17 1.7%	64 6.3%	60 5.9%	118 11.6%	199 19.5%	161 15.8%	364 35.7%	10 1.0%	**8.25**	↑ 0.37
↓ 5	**8**	Italy	1,021	6 0.6%	6 0.6%	11 1.1%	25 2.4%	28 2.7%	70 6.8%	134 13.1%	198 19.4%	203 19.9%	326 31.9%	14 1.4%	**8.25**	↑ 0.13
↑ 1	**9**	Bulgaria	1,041	9 0.9%	2 0.2%	11 1.1%	18 1.7%	56 5.4%	86 8.3%	137 13.2%	179 17.2%	149 14.3%	360 34.6%	34 3.3%	**8.19**	↑ 0.29
↓ 6	**10**	France	1,030	19 1.8%	8 0.8%	17 1.7%	17 1.7%	69 6.7%	51 5.0%	133 12.9%	194 18.9%	108 10.5%	408 39.7%	6 0.6%	**8.15**	↑ 0.07
↑ 2	**11**	Germany	1,539	38 2.5%	11 0.7%	24 1.6%	28 1.8%	100 6.5%	73 4.7%	193 12.5%	264 17.2%	208 13.5%	586 38.1%	14 0.9%	**8.12**	↑ 0.41
↓ 4	**12**	Sweden	1,033	11 1.1%	4 0.4%	9 0.9%	15 1.5%	75 7.3%	45 4.4%	179 17.3%	215 20.8%	177 17.1%	301 29.1%	2 0.2%	**8.07**	↑ 0.09
↓ 1	**13**	Luxembourg	501	14 2.8%	6 1.2%	15 3.0%	6 1.2%	39 7.8%	36 7.2%	45 9.0%	77 15.3%	47 9.4%	212 42.2%	4 0.8%	**7.99**	↑ 0.15
=	**14**	Slovenia	1,003	30 3.0%	8 0.8%	17 1.7%	12 1.2%	68 6.8%	90 9.0%	129 12.9%	189 18.8%	111 11.1%	334 33.3%	15 1.5%	**7.87**	↑ 0.24

Table D.4 – Overall European public's perception, in 2019, how serious a problem they think climate change is currently (Continued)

No.		Country	*N*	1	2	3	4	5	6	7	8	9	10	Don't Know	Average	
↑ 8	**15**	Ireland	1,067	12 1.1%	7 0.7%	6 0.6%	14 1.3%	106 9.9%	108 10.1%	163 15.3%	201 18.8%	118 11.1%	324 30.4%	8 0.7%	**7.86**	↑ 0.54
↑ 3	**16**	Slovakia	1,076	2 0.2%	4 0.4%	5 0.5%	17 1.6%	95 8.8%	95 8.8%	205 19.1%	231 21.5%	171 15.9%	233 21.7%	18 1.7%	**7.84**	↑ 0.33
↑ 7	**17**	United Kingdom	1,052	29 2.8%	9 0.9%	24 2.3%	22 2.1%	94 8.9%	70 6.7%	129 12.3%	189 18.0%	116 11.0%	359 34.1%	11 1.0%	**7.83**	↑ 0.64
↑ 7	**18**	Poland	1,005	17 1.7%	5 0.5%	16 1.6%	18 1.8%	104 10.3%	100 9.9%	149 14.7%	198 19.5%	109 10.8%	253 25.0%	46 4.5%	**7.66**	↑ 0.65
↓ 1	**19**	Croatia	1,015	9 0.9%	8 0.8%	23 2.3%	36 3.5%	100 9.8%	101 9.9%	145 14.3%	191 18.8%	118 11.6%	276 27.2%	8 0.8%	**7.65**	↑ 0.12
↑ 1	**20**	Finland	1,005	9 0.9%	18 1.8%	33 3.3%	32 3.2%	64 6.4%	76 7.6%	141 14.0%	256 25.4%	157 15.6%	213 21.2%	6 0.6%	**7.63**	↑ 0.16
↓ 6	**21**	Lithuania	1,003	21 2.1%	14 1.4%	25 2.5%	25 2.5%	111 11.1%	77 7.7%	124 12.4%	209 20.9%	116 11.6%	276 27.6%	5 0.5%	**7.62**	=
↓ 7	**22**	Romania	1,052	13 1.2%	1 0.1%	21 2.0%	31 3.0%	107 10.2%	128 12.2%	146 13.9%	151 14.3%	123 11.7%	273 25.9%	58 5.5%	**7.61**	↓ 0.01
↑ 3	**23**	Czech Republic	1,020	12 1.2%	5 0.5%	34 3.3%	29 2.8%	120 11.8%	84 8.2%	170 16.7%	167 16.4%	94 9.2%	293 28.8%	12 1.2%	**7.59**	↑ 0.69
↓ 4	**24**	Belgium	1,027	7 0.7%	7 0.7%	13 1.3%	28 2.7%	105 10.2%	117 11.4%	211 20.5%	194 18.9%	117 11.4%	227 22.1%	1 0.1%	**7.54**	↑ 0.06
↓ 3	**25**	Austria	1,039	28 2.7%	18 1.7%	45 4.3%	42 4.0%	77 7.4%	84 8.1%	140 13.5%	190 18.3%	94 9.0%	314 30.2%	7 0.7%	**7.50**	↑ 0.11
↓ 9	**26**	Netherlands	1,022	23 2.3%	6 0.6%	13 1.3%	27 2.6%	100 9.8%	90 8.8%	201 19.7%	282 27.6%	115 11.3%	162 15.9%	3 0.3%	**7.40**	↓ 0.17
=	**27**	Latvia	1,003	33 3.3%	13 1.3%	25 2.5%	38 3.8%	159 15.9%	126 12.6%	165 16.5%	186 18.5%	65 6.5%	177 17.6%	16 1.6%	**6.93**	↑ 0.35
=	**28**	Estonia	1,009	45 4.5%	28 2.8%	33 3.3%	31 3.1%	144 14.4%	106 10.6%	167 16.7%	178 17.8%	65 6.5%	180 18.0%	22 2.2%	**6.81**	↑ 0.51

Table D.4 – Overall European public's perception, in 2019, how serious a problem they think climate change is currently (Continued)

No.		Country	*N*	1	2	3	4	5	6	7	8	9	10	Don't Know	Average	
-	-	European Union (EU-28)	27,655	392 1.4%	210 0.8%	476 1.7%	591 2.1%	2,189 7.9%	2,134 7.7%	3,950 14.3%	5,431 19.6%	3,661 13.2%	8,265 29.9%	356 1.3%	**7.88**	↑ **0.29**
-	-	European Union (EU-27)[60]	26,599	363 1.4%	201 0.8%	452 1.7%	569 2.1%	2,095 7.9%	2,064 7.8%	3,821 14.4%	5,242 19.7%	3,545 13.3%	7,906 29.7%	345 1.3%	**7.88**	↑ **0.27**

No. = Number; *N* = Number of Respondents; Note: All Percentages might not add up to 100 per cent due to rounding errors

Source: Data Adapted from Eurobarometer (2019)

[60] - EU27 means all European Union countries in 2019 excluding the United Kingdom

Table D.5 –European public's perception, between the age of 16 and 24 in 2017, of how serious a problem they think climate change is currently

No.	Country	*N*	1	2	3	4	5	6	7	8	9	10	Don't Know	Average
1	Malta	73	0 0.0%	0 0.0%	0 0.0%	0 0.0%	3 4.1%	9 12.3%	10 13.7%	11 15.1%	16 21.9%	24 32.9%	0 0.0%	**8.37**
2	Greece	119	1 0.8%	0 0.0%	2 1.7%	2 1.7%	4 3.4%	4 3.4%	12 10.1%	35 29.4%	26 21.8%	33 27.7%	0 0.0%	**8.29**
3	Italy	111	0 0.0%	0 0.0%	1 0.9%	1 0.9%	4 3.6%	9 8.1%	17 15.3%	28 25.2%	17 15.3%	34 30.6%	0 0.0%	**8.26**
4	Spain	111	0 0.0%	0 0.0%	0 0.0%	1 0.9%	11 9.9%	2 1.8%	17 15.3%	29 26.1%	19 17.1%	32 28.8%	0 0.0%	**8.23**
5	Sweden	104	3 2.9%	0 0.0%	0 0.0%	3 2.9%	6 5.8%	6 5.8%	12 11.5%	22 21.2%	12 11.5%	40 38.5%	0 0.0%	**8.16**
6	Portugal	131	0 0.0%	0 0.0%	0 0.0%	3 2.3%	11 8.4%	7 5.3%	25 19.1%	27 20.6%	19 14.5%	39 29.8%	0 0.0%	**8.10**
7	Luxembourg	71	1 1.4%	1 1.4%	0 0.0%	0 0.0%	5 7.0%	9 12.7%	12 16.9%	11 15.5%	10 14.1%	22 31.0%	0 0.0%	**7.94**
8	Slovakia	147	0 0.0%	0 0.0%	0 0.0%	4 2.7%	11 7.5%	23 15.6%	21 14.3%	22 15.0%	22 15.0%	42 28.6%	2 1.4%	**7.93**
9	Germany	190	4 2.1%	1 0.5%	3 1.6%	11 5.8%	13 6.8%	5 2.6%	24 12.6%	49 25.8%	19 10.0%	57 30.0%	4 2.1%	**7.82**
10	France	139	1 0.7%	1 0.7%	0 0.0%	5 3.6%	10 7.2%	17 12.2%	25 18.0%	26 18.7%	12 8.6%	40 28.8%	2 1.4%	**7.78**
11	Hungary	141	0 0.0%	2 1.4%	2 1.4%	4 2.8%	12 8.5%	9 6.4%	28 19.9%	33 23.4%	17 12.1%	34 24.1%	0 0.0%	**7.75**
12	Bulgaria	120	0 0.0%	2 1.7%	0 0.0%	1 0.8%	11 9.2%	13 10.8%	26 21.7%	18 15.0%	8 6.7%	30 25.0%	11 9.2%	**7.70**
13	Lithuania	148	5 3.4%	0 0.0%	3 2.0%	1 0.7%	15 10.1%	23 15.5%	18 12.2%	18 12.2%	15 10.1%	50 33.8%	0 0.0%	**7.68**
14	Cyprus	83	0 0.0%	0 0.0%	0 0.0%	4 4.8%	11 13.3%	6 7.2%	14 16.9%	20 24.1%	8 9.6%	18 21.7%	2 2.4%	**7.62**

Table D.5 –European public's perception, between the age of 16 and 24 in 2017, of how serious a problem they think climate change is currently (Continued)

No.	Country	*N*	1	2	3	4	5	6	7	8	9	10	Don't Know	Average
15	Austria	133	2 1.5%	0 0.0%	4 3.0%	5 3.8%	10 7.5%	13 9.8%	17 12.8%	41 30.8%	12 9.0%	29 21.8%	0 0.0%	**7.57**
16	Ireland	145	0 0.0%	3 2.1%	2 1.4%	7 4.8%	13 9.0%	12 8.3%	28 19.3%	29 20.0%	19 13.1%	31 21.4%	1 0.7%	**7.54**
17	Belgium	140	0 0.0%	3 2.1%	4 2.9%	6 4.3%	6 4.3%	25 17.9%	26 18.6%	19 13.6%	15 10.7%	36 25.7%	0 0.0%	**7.51**
18	Netherlands	144	0 0.0%	0 0.0%	1 0.7%	2 1.4%	10 6.9%	18 12.5%	45 31.3%	37 25.7%	15 10.4%	14 9.7%	2 1.4%	**7.43**
19	Slovenia	117	2 1.7%	0 0.0%	1 0.9%	3 2.6%	16 13.7%	12 10.3%	19 16.2%	22 18.8%	13 11.1%	22 18.8%	7 6.0%	**7.41**
20	Finland	138	3 2.2%	0 0.0%	5 3.6%	6 4.3%	10 7.2%	14 101%	28 20.3%	29 21.0%	12 8.7%	30 21.7%	1 0.7%	**7.39**
21	Denmark	150	0 0.0%	2 1.3%	6 4.0%	7 4.7%	21 14.0%	14 9.3%	25 16.7%	29 19.3%	14 9.3%	32 21.3%	0 0.0%	**7.28**
22	United Kingdom	208	5 2.4%	2 1.0%	8 3.8%	2 1.0%	26 12.5%	28 13.5%	43 20.7%	25 12.0%	19 9.1%	42 20.2%	8 3.8%	**7.16**
23	Romania	133	1 0.8%	0 0.0%	3 2.3%	4 3.0%	17 12.8%	30 22.6%	28 21.1%	13 9.8%	9 6.8%	27 20.3%	1 0.8%	**7.14**
24	Croatia	137	3 2.2%	4 2.9%	5 3.6%	6 4.4%	11 8.0%	21 15.3%	17 12.4%	26 19.0%	10 7.3%	30 21.9%	4 2.9%	**7.13**
25	Poland	139	3 2.2%	0 0.0%	0 0.0%	8 5.8%	25 18.0%	17 12.2%	21 15.1%	31 22.3%	12 8.6%	15 10.8%	7 5.0%	**6.93**
26	Latvia	127	6 4.7%	0 0.0%	1 0.8%	7 5.5%	26 20.5%	21 16.5%	27 21.3%	16 12.6%	12 9.4%	10 7.9%	1 0.8%	**6.49**
27	Estonia	128	6 4.7%	4 3.1%	2 1.6%	17 13.3%	9 7.0%	22 17.2%	17 13.3%	27 21.1%	3 2.3%	18 14.1%	3 2.3%	**6.46**

Table D.5 –European public's perception, between the age of 16 and 24 in 2017, of how serious a problem they think climate change is currently (Continued)

No.	Country	*N*	1	2	3	4	5	6	7	8	9	10	Don't Know	Average
28	Czech Republic	130	5 3.8%	5 3.8%	3 2.3%	6 4.6%	25 19.2%	21 16.2%	28 21.5%	18 13.8%	5 3.8%	12 9.2%	2 1.5%	**6.28**
-	European Union (EU-28)	3,657	51 1.4%	30 0.8%	56 1.5%	126 3.4%	352 9.6%	410 11.2%	630 17.2%	711 19.4%	390 10.7%	843 23.1%	58 1.6%	**7.51**
-	European Union (EU-27)[61]	3,449	46 1.3%	28 0.8%	48 1.4%	124 3.6%	326 9.5%	382 11.1%	587 17.0%	686 19.9%	371 10.8%	801 23.2%	50 1.4%	**7.53**

No. = Number; *N* = Number of Respondents; Note: All Percentages might not add up to 100 per cent due to rounding errors

Source: Data Adapted from Eurobarometer (2017)

[61] - EU27 means all European Union countries in 2019 excluding the United Kingdom

Table D.6 –European public's perception, between the age of 16 and 24 in 2019, of how serious a problem they think climate change is currently

No.		Country	*N*	1	2	3	4	5	6	7	8	9	10	Don't Know	Average	
=	**1**	Malta	73	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	5 6.8%	9 12.3%	7 9.6%	14 19.2%	36 49.3%	2 2.7%	**8.82**	↑ **0.45**
↑ **1**	**2**	Italy	111	0 0.0%	0 0.0%	0 0.0%	1 0.9%	2 1.8%	6 5.4%	10 9.0%	23 20.7%	27 24.3%	42 37.8%	0 0.0%	**8.71**	↑ **0.45**
↑ **1**	**3**	Spain	111	1 0.9%	1 0.9%	0 0.0%	3 2.7%	0 0.0%	9 8.1%	8 7.2%	18 16.2%	22 19.8%	49 44.1%	0 0.0%	**8.62**	↑ **0.39**
↑ **7**	**4**	Hungary	137	0 0.0%	2 1.5%	0 0.0%	2 1.5%	3 2.2%	5 3.6%	22 16.1%	18 13.1%	29 21.2%	50 36.5%	6 4.4%	**8.52**	↑ **0.77**
↑ **16**	**5**	Denmark	152	0 0.0%	0 0.0%	2 1.3%	2 1.3%	7 4.6%	4 2.6%	23 15.1%	22 14.5%	31 20.4%	61 40.1%	0 0.0%	**8.49**	↑ **1.21**
↓ **1**	**6**	Sweden	56	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	16 28.6%	12 21.4%	16 28.6%	12 21.4%	0 0.0%	**8.43**	↑ **0.27**
↑ **8**	**7**	Austria	140	1 0.7%	3 2.1%	3 2.1%	3 2.1%	4 2.9%	6 4.3%	13 9.3%	32 22.9%	16 11.4%	59 42.1%	0 0.0%	**8.38**	↑ **0.81**
↑ **6**	**8**	Cyprus	77	0 0.0%	0 0.0%	0 0.0%	0 0.0%	5 6.5%	3 3.9%	12 15.6%	25 32.5%	11 14.3%	21 27.3%	0 0.0%	**8.26**	↑ **0.64**
↑ **3**	**9**	Bulgaria	121	3 2.5%	2 1.7%	1 0.8%	0 0.0%	5 4.1%	8 6.6%	16 13.2%	20 16.5%	22 18.2%	39 32.2%	5 4.1%	**8.20**	↑ **0.50**
↓ **4**	**10**	Portugal	124	0 0.0%	0 0.0%	0 0.0%	6 4.8%	4 3.2%	11 8.9%	20 16.1%	25 20.2%	15 12.1%	43 34.7%	0 0.0%	**8.19**	↑ **0.09**
↓ **9**	**11**	Greece	118	0 0.0%	1 0.8%	1 0.8%	3 2.5%	5 4.2%	5 4.2%	17 14.4%	30 25.4%	28 23.7%	28 23.7%	0 0.0%	**8.03**	↓ **0.26**
↓ **2**	**12**	France	145	1 0.7%	2 1.4%	4 2.8%	4 2.8%	5 3.4%	6 4.1%	27 18.6%	35 24.1%	13 9.0%	48 33.1%	0 0.0%	**8.00**	↑ **0.22**
↓ **4**	**13**	Germany	191	2 1.0%	0 0.0%	4 2.1%	8 4.2%	11 5.8%	11 5.8%	27 14.1%	32 16.8%	37 19.4%	55 28.8%	4 2.1%	**7.99**	↑ **0.17**
↓ **7**	**14**	Luxembourg	69	2 2.9%	3 4.3%	1 1.4%	5 7.2%	2 2.9%	2 2.9%	2 2.9%	11 15.9%	6 8.7%	33 47.8%	2 2.9%	**7.93**	↓ **0.01**

Table D.6 –European public's perception, between the age of 16 and 24 in 2019, of how serious a problem they think climate change is currently (Continued)

No.		Country	*N*	1	2	3	4	5	6	7	8	9	10	Don't Know	Average	
↑ 5	**15**	Finland	138	0 0.0%	3 2.2%	2 1.4%	1 0.7%	7 5.1%	9 6.5%	18 13.0%	45 32.6%	30 21.7%	23 16.7%	0 0.0%	**7.91**	↑ **0.52**
↓ 3	**16**	Lithuania	148	3 2.0%	2 1.4%	0 0.0%	7 4.7%	10 6.8%	10 6.8%	23 15.5%	23 15.5%	22 16.9%	48 32.4%	0 0.0%	**7.89**	↑ **0.21**
↑ 5	**17**	United Kingdom	164	1 0.6%	1 0.6%	2 1.2%	4 2.4%	14 8.5%	16 9.8%	22 13.4%	37 22.6%	19 11.6%	48 29.3%	0 0.0%	**7.88**	↑ **0.72**
↑ 1	**18**	Slovenia	114	9 7.9%	1 0.9%	0 0.0%	1 0.9%	3 2.6%	16 14.0%	8 7.0%	19 16.7%	23 20.2%	34 29.8%	0 0.0%	**7.73**	↑ **0.32**
↓ 3	**19**	Ireland	151	4 2.6%	2 1.3%	1 0.7%	1 0.7%	20 13.2%	10 6.6%	14 9.3%	31 20.5%	24 15.9%	42 27.8%	2 1.3%	**7.71**	↑ **0.17**
↓ 3	**20**	Belgium	141	1 0.7%	0 0.0%	0 0.0%	4 2.8%	10 7.1%	15 10.6%	35 24.8%	27 19.1%	21 14.9%	28 19.9%	0 0.0%	**7.65**	↑ **0.14**
↓ 13	**21**	Slovakia	155	1 0.6%	3 1.9%	1 0.6%	6 3.9%	17 11.0%	16 10.3%	22 14.2%	29 18.7%	28 18.1%	31 20.0%	1 0.6%	**7.55**	↓ **0.38**
↑ 2	**22**	Croatia	133	0 0.0%	1 0.8%	3 2.3%	6 4.5%	17 12.8%	12 9.0%	19 14.3%	25 18.8%	16 12.0%	31 23.3%	3 2.3%	**7.53**	↑ **0.40**
↑ 2	**23**	Poland	141	1 0.7%	0 0.0%	3 2.1%	4 2.8%	19 13.5%	18 12.8%	13 9.2%	22 15.6%	16 11.3%	35 24.8%	10 7.1%	**7.50**	↑ **0.57**
↑ 3	**24**	Estonia	127	2 1.6%	2 1.6%	2 1.6%	2 1.6%	18 14.2%	9 7.1%	28 22.0%	19 15.0%	12 9.4%	31 24.4%	2 1.6%	**7.50**	↑ **1.04**
↓ 7	**25**	Netherlands	138	0 0.0%	0 0.0%	0 0.0%	8 5.8%	12 8.7%	12 8.7%	33 23.9%	42 30.4%	9 6.5%	22 15.9%	0 0.0%	**7.42**	↓ **0.01**
↓ 3	**26**	Romania	135	0 0.0%	1 0.7%	4 3.0%	4 3.0%	19 14.1%	18 13.3%	21 15.6%	21 15.6%	12 8.9%	30 22.2%	5 3.7%	**7.30**	↑ **0.16**
↓ 1	**27**	Latvia	125	5 4.0%	0 0.0%	1 0.8%	7 5.6%	13 10.4%	14 11.2%	27 21.6%	35 280%	11 8.8%	12 9.6%	0 0.0%	**6.87**	↑ **0.38**

Table D.6 –European public's perception, between the age of 16 and 24 in 2019, of how serious a problem they think climate change is currently (Continued)

No.		Country	*N*	1	2	3	4	5	6	7	8	9	10	Don't Know	Average	
=	**28**	Czech Republic	122	4 3.3%	3 2.4%	9 7.3%	5 4.1%	13 10.6%	13 10.6%	30 24.4%	18 14.6%	7 5.7%	20 16.3%	0 0.0%	**6.64**	↑ **0.36**
-	**-**	European Union (EU-28)	3,557	41 1.2%	33 0.9%	44 1.2%	97 2.7%	245 6.9%	269 7.6%	535 15.0%	703 19.8%	537 15.1%	1,011 28.4%	42 1.2%	**7.90**	↑ **0.29**
-	**-**	European Union (EU-27)[62]	3,393	40 1.2%	32 0.9%	42 1.2%	93 2.7%	231 6.8%	253 7.5%	513 15.1%	666 19.6%	518 15.3%	963 28.4%	42 1.2%	**7.90**	↑ **0.27**

No. = Number; *N* = Number of Respondents; Note: All Percentages might not add up to 100 per cent due to rounding errors

Source: Data Adapted from Eurobarometer (2019)

[62] - EU27 means all European Union countries in 2019 excluding the United Kingdom

Table D.7 – Overall European public's perception, in 2019, of how serious a problem they think climate change is currently, based upon NUTS1 regions

No.	Region		*N*	1	2	3	4	5	6	7	8	9	10	Don't Know	Average	
1	Jugovzhodna Slovenija (Southeast Slovenia)	Slovenia	69	0 0.0%	0 0.0%	2 2.9%	0 0.0%	2 2.9%	0 0.0%	4 5.8%	5 7.2%	2 2.9%	53 76.8%	0 0.0%	**9.16**	**+ 1.74**
2	Islas Canarias (Canary Islands)	Spain	46	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	2 4.3%	4 8.7%	9 19.6%	6 13.0%	24 52.2%	1 2.2%	**9.02**	**+ 0.82**
3	Free Hanseatic City of Bremen	Germany	13	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	1 7.7%	5 38.5%	0 0.0%	7 53.8%	0 0.0%	**9.00**	**+ 0.23**
4	Tauragės apskritis (Tauragė County)	Lithuania	36	2 5.6%	0 0.0%	0 0.0%	0 0.0%	1 2.8%	0 0.0%	2 5.6%	2 5.6%	4 11.1%	25 69.4%	0 0.0%	**8.97**	**- 0.56**
5	Malta	Malta	507	1 0.2%	1 0.2%	2 0.4%	1 0.2%	6 1.2%	22 4.3%	44 8.7%	79 15.6%	86 17.0%	257 50.7%	6 1.2%	**8.90**	**+ 0.90**
6	Nyugat-Dunántúl (Western Transdanubia)	Hungary	103	0 0.0%	0 0.0%	0 0.0%	0 0.0%	1 1.0%	6 5.8%	14 13.6%	18 17.5%	10 9.7%	54 52.4%	0 0.0%	**8.86**	**+ 1.16**
7	Észak-Dunántúl (Northern Transdanubia)	Hungary	111	0 0.0%	0 0.0%	0 0.0%	1 0.9%	6 5.4%	6 5.4%	12 10.8%	21 18.9%	12 10.8%	53 47.7%	2 1.8%	**8.81**	**+ 0.11**
8	Italia nord-occidentale (Northwest Italy)	Italy	270	0 0.0%	0 0.0%	1 0.4%	0 0.0%	2 0.7%	14 5.1%	20 7.3%	55 20.1%	72 26.3%	105 38.3%	4 1.5%	**8.80**	**+ 0.50**
9	Noroeste (Northwest)	Spain	99	0 0.0%	1 1.0%	1 1.0%	0 0.0%	2 2.0%	2 2.0%	9 9.1%	20 20.2%	12 12.1%	50 50.5%	1 1.0%	**8.76**	**+ 0.30**
10	Voreia Ellada (Northern Greece)	Greece	332	1 0.3%	0 0.0%	1 0.3%	0 0.0%	6 1.8%	9 2.7%	34 10.2%	84 25.3%	80 24.1%	118 35.5%	0 0.0%	**8.73**	**+ 0.43**
11	Sjælland (Zealand)	Denmark	148	1 0.7%	1 0.7%	0 0.0%	2 1.4%	4 2.7%	3 2.0%	15 10.1%	39 26.4%	24 16.2%	60 40.5%	1 0.7%	**8.72**	**+ 1.10**
	Este (East)	Spain	293	1 0.3%	0 0.0%	2 0.7%	2 0.7%	7 2.4%	7 2.4%	32 10.9%	61 20.8%	50 17.1%	130 44.4%	0 0.0%		**+ 0.73**
13	Zasavska (Central Sava)	Slovenia	21	0 0.0%	0 0.0%	0 0.0%	0 0.0%	1 4.8%	2 9.5%	1 4.8%	4 19.0%	3 14.3%	10 47.6%	0 0.0%	**8.71**	**+ 1.12**

Table D.7 – Overall European public's perception, in 2019, of how serious a problem they think climate change is currently, based upon NUTS1 regions (Continued)

No.	Region		*N*	1	2	3	4	5	6	7	8	9	10	Don't Know	Average	
14	Centro (Centre)	Spain	126	0 0.0%	0 0.0%	0 0.0%	1 0.8%	2 1.6%	11 8.7%	19 15.1%	16 12.7%	16 12.7%	60 47.6%	1 0.8%	**8.68**	**+ 0.70**
15	Attikís (Attica)	Greece	397	0 0.0%	1 0.3%	0 0.0%	3 0.8%	12 3.0%	14 3.5%	39 9.8%	97 24.4%	90 22.7%	140 35.3%	1 0.3%	**8.63**	**+ 0.37**
16	Lisboa (Lisbon)	Portugal	282	0 0.0%	0 0.0%	1 0.4%	1 0.4%	14 5.0%	14 5.0%	37 13.1%	52 18.4%	40 142%	121 42.9%	2 0.7%	**8.59**	**+ 0.06**
17	Hovedstaden (The Capital)	Denmark	310	0 0.0%	0 0.0%	3 1.0%	4 1.3%	9 2.9%	18 5.7%	30 9.5%	57 18.1%	65 20.6%	123 39.0%	5 1.6%	**8.58**	**+ 0.38**
	South West England	United Kingdom	90	0 0.0%	0 0.0%	1 1.1%	1 1.1%	8 8.9%	1 1.1%	2 2.2%	13 14.4%	19 21.1%	43 47.8%	0 0.0%		**+ 1.59**
19	Île-de-France (Island of France)	France	193	3 1.6%	1 0.5%	1 0.5%	2 1.0%	11 5.7%	7 3.6%	19 9.8%	33 17.1%	12 6.2%	101 52.3%	2 1.0%	**8.52**	**+ 0.43**
	Northern Ireland	United Kingdom	30	0 0.0%	0 0.0%	0 0.0%	0 0.0%	5 16.7%	1 3.3%	3 10.0%	5 16.7%	5 16.7%	11 36.7%	1 3.3%		**+ 1.41**
21	Hamburg	Germany	35	2 5.7%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	1 2.9%	3 8.6%	6 17.1%	9 25.7%	14 40.0%%	0 0.0%	**8.51**	**+ 0.51**
22	Észak-Magyarország (Northern Hungary)	Hungary	121	0 0.0%	1 0.8%	1 0.8%	0 0.0%	6 5.0%	2 1.7%	19 15.7%	24 19.8%	23 19.0%	45 37.2%	0 0.0%	**8.50**	**+ 0.25**
23	Yugozapaden (Southwestern)	Bulgaria	303	2 0.7%	0 0.0%	3 1.0%	4 1.3%	11 3.6%	19 6.3%	39 12.9%	52 17.2%	40 13.2%	125 41.3%	9 3.0%	**8.49**	**+ 0.32**
	Południowo-Zachodni	Poland	103	1 1.0%	0 0.0%	1 1.0%	0 0.0%	7 6.8%	6 5.8%	13 12.6%	16 15.5%	12 11.7%	43 41.7%	5 4.9%		**+ 1.21**
25	South-East	Ireland	117	0 0.0%	0 0.0%	0 0.0%	0 0.0%	13 11.1%	7 6.0%	16 13.7%	19 16.2%	12 10.3%	51 43.6%	0 0.0%	**8.45**	**+ 1.95**

Table D.7 – Overall European public's perception, in 2019, of how serious a problem they think climate change is currently, based upon NUTS1 regions (Continued)

No.	Region		N	1	2	3	4	5	6	7	8	9	10	Don't Know	Average	
26	Região do Alentejo (Alentejo Region)	Portugal	77	0 0.0%	0 0.0%	1 1.3%	0 0.0%	4 5.2%	3 3.9%	10 13.0%	25 32.5%	12 15.6%	23 29.9%	0 0.0%	**8.43**	**+ 0.11**
	Região do Norte (North Region)	Portugal	373	0 0.0%	0 0.0%	0 0.0%	6 1.6%	21 5.6%	23 6.2%	36 9.7%	73 19.6%	94 25.2%	118 31.6%	2 0.5%		**+ 0.66**
28	Bavaria (Bayern)	Germany	245	1 0.4%	3 1.2%	1 0.4%	3 1.2%	15 6.1%	12 4.9%	32 13.1%	37 15.1%	34 13.9%	103 42.0%	4 1.6%	**8.40**	**+ 0.25**
29	Primorsko-notranjska (Littoral–Inner Carniola)	Slovenia	25	0 0.0%	0 0.0%	0 0.0%	0 0.0%	2 8.0%	1 4.0%	3 12.0%	2 8.0%	2 8.0%	13 52.0%	1 4.0%	**8.38**	**+ 0.38**
30	Dél-Alföld (Southern Great Plain)	Hungary	134	0 0.0%	0 0.0%	0 0.0%	1 0.7%	12 9.0%	9 6.7%	11 8.2%	28 20.9%	20 14.9%	52 38.8%	0 0.0%	**8.35**	**+ 0.37**
	South Sweden (Sydsverige)	Sweden	153	0 0.0%	0 0.0%	1 0.7%	2 1.3%	6 3.9%	6 3.9%	29 19.0%	25 16.3%	33 21.6%	50 32.7%	0 0.0%		**+ 0.22**
32	Småland and the islands (Småland med öarna)	Sweden	89	0 0.0%	0 0.0%	1 1.1%	1 1.1%	4 4.5%	7 7.9%	12 13.5%	13 14.6%	21 23.6%	28 31.5%	2 2.2%	**8.34**	**+ 0.46**
33	Cyprus	Cyprus	504	0 0.0%	2 0.4%	3 0.6%	11 2.2%	37 7.3%	29 5.8%	61 12.1%	94 18.7%	72 14.3%	192 38.1%	4 0.8%	**8.33**	**+ 0.37**
	Rheinland-Pfalz (Rhineland-Palatinate)	Germany	39	0 0.0%	0 0.0%	1 2.6%	0 0.0%	0 0.0%	2 5.1%	8 20.5%	5 12.8%	6 15.4%	16 41.0%	0 0.0%		**+ 0.10**
35	Kentriki Ellada (Central Greece)	Greece	222	0 0.0%	0 0.0%	5 2.3%	3 1.4%	11 5.0%	8 3.6%	23 10.4%	66 29.7%	43 19.4%	64 28.8%	0 0.0%	**8.32**	**+ 0.12**
36	Sur (South)	Spain	211	0 0.0%	3 1.4%	2 0.9%	7 3.3%	7 3.3%	7 3.3%	25 11.8%	53 25.1%	41 19.4%	66 31.3%	1 0.5%	**8.31**	**+ 0.16**

Table D.7 – Overall European public's perception, in 2019, of how serious a problem they think climate change is currently, based upon NUTS1 regions (Continued)

No.	Region		*N*	1	2	3	4	5	6	7	8	9	10	Don't Know	Average	
37	Nordjylland (North Jutland)	Denmark	106	0 0.0%	0 0.0%	2 1.9%	1 0.9%	8 7.5%	4 3.8%	13 12.3%	25 23.6%	14 13.2%	38 35.8%	1 0.9%	**8.30**	**+ 0.47**
	Italia meridionale (Southern Italy)	Italy	198	0 0.0%	0 0.0%	2 0.9%	10 4.4%	9 3.9%	11 4.8%	40 17.5%	36 15.7%	38 16.6%	80 34.9%	4 1.7%		**+ 0.47**
	Comunidad de Madrid (Community of Madrid)	Spain	138	0 0.0%	1 0.7%	0 0.0%	6 4.3%	3 2.2%	10 7.2%	18 13.0%	29 21.0%	29 21.0%	40 29.0%	3 2.2%		**- 0.29**
40	Centre-Est (Centre East)	France	127	1 0.8%	1 0.8%	4 3.1%	1 0.8%	6 4.7%	10 7.9%	13 10.2%	23 18.1%	13 10.2%	55 43.3%	0 0.0%	**8.28**	**+ 0.32**
	Ouest (West)	France	144	4 2.8%	0 0.0%	1 0.7%	1 0.7%	10 6.9%	8 5.6%	19 13.2%	24 16.7%	21 14.6%	57 39.6%	0 0.0%		**+ 0.08**
42	Goriška Gorizia	Slovenia	58	1 1.7%	0 0.0%	1 1.7%	1 1.7%	3 5.2%	2 3.4%	5 8.6%	5 8.6%	10 17.2%	23 39.7%	6 10.3%	**8.27**	**+ 0.19**
43	Severoiztochen (Northeastern)	Bulgaria	137	0 0.0%	0 0.0%	0 0.0%	0 0.0%	8 5.8%	16 11.7%	23 16.8%	27 19.7%	22 16.1%	42 30.7%	0 0.0%	**8.26**	**+ 0.10**
	Helsinki-Uusimaa	Finland	292	1 0.3%	0 0.0%	7 2.4%	4 1.4%	11 3.8%	15 5.1%	34 11.6%	76 26.0%	46 15.8%	96 32.9%	1 0.1%		**+ 0.38**
45	Mid-East	Ireland	122	4 3.3%	1 0.8%	1 0.8%	0 0.0%	5 4.1%	10 8.2%	14 11.5%	23 18.9%	8 6.6%	55 45.1%	1 0.8%	**8.25**	**+ 0.66**
46	Baden-Württemberg	Germany	210	14 6.7%	0 0.0%	6 2.9%	4 1.9%	9 4.3%	4 1.9%	21 10.0%	13 6.2%	21 10.0%	116 55.2%	1 0.5%	**8.22**	**+ 0.65**
47	Észak-Alföld (Northern Great Plain)	Hungary	152	0 0.0%	2 1.3%	3 2.0%	4 2.6%	8 5.3%	7 4.6%	22 14.5%	23 15.1%	31 20.4%	52 34.2%	0 0.0%	**8.21**	**+ 0.18**
	Noreste (Northeast)	Spain	98	0 0.0%	1 1.0%	0 0.0%	1 1.0%	11 11.2%	7 7.1%	7 7.1%	20 20.4%	16 16.3%	34 34.7%	1 1.0%		**- 0.30**

Table D.7 – Overall European public's perception, in 2019, of how serious a problem they think climate change is currently, based upon NUTS1 regions (Continued)

No.	Region		*N*	1	2	3	4	5	6	7	8	9	10	Don't Know	Average	
49	Severen tsentralen (Northern Central)	Bulgaria	120	2 1.7%	0 0.0%	0 0.0%	2 1.7%	5 4.2%	12 10.0%	13 10.8%	20 16.7%	22 18.3%	37 30.8%	7 5.8%	**8.19**	**= 0.00**
	Bassin Parisien (Paris Basin)	France	177	3 1.7%	2 1.1%	2 1.1%	2 1.1%	11 6.2%	9 5.1%	17 9.6%	50 28.2%	9 51%	72 40.7%	0 0.0%		**+ 0.61**
51	Nordrhein-Westfalen (North Rhine-Westphalia)	Germany	345	6 1.7%	4 1.2%	4 1.2%	6 1.7%	19 5.5%	20 5.8%	37 10.7%	71 20.6%	51 14.8%	123 35.7%	5 1.4%	**8.18**	**+ 0.38**
	Middle Norrland (Mellersta Norrland)	Sweden	40	3 7.5%	0 0.0%	0 0.0%	1 2.5%	0 0.0%	3 7.5%	5 12.5%	2 5.0%	9 22.5%	17 42.5%	0 0.0%		**+ 0.38**
53	Italia centrale (Central Italy)	Italy	206	0 0.0%	1 0.5%	3 1.5%	5 2.4%	5 2.4%	11 5.3%	38 18.4%	44 21.4%	37 18.0%	61 29.6%	0 0.0%	**8.17**	**- 0.01**
	Koroška (Carinthia)	Slovenia	35	0 0.0%	0 0.0%	0 0.0%	0 0.0%	6 17.1%	2 5.7%	4 11.4%	5 14.3%	4 11.4%	14 40.0%	0 0.0%		**+ 0.50**
55	Algarve	Portugal	45	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	4 8.9%	23 51.1%	15 33.3%	2 4.4%	0 0.0%	**8.16**	**- 0.20**
56	Schleswig-Holstein	Germany	55	1 1.8%	2 3.6%	0 0.0%	1 1.8%	1 1.8%	0 0.0%	4 7.3%	8 14.5%	18 32.7%	18 32.7%	0 0.0%	**8.15**	**+ 1.02**
	West Sweden (Västsverige)	Sweden	206	1 0.5%	1 0.5%	2 1.0%	4 1.9%	10 4.9%	9 4.4%	40 19.4%	44 21.4%	32 15.5%	63 30.6%	0 0.0%		**+ 0.20**
59	Italia nord-orientale (Northeastern Italy)	Italy	198	4 2.0%	0 0.0%	2 1.0%	3 1.5%	5 2.5%	13 6.6%	25 12.6%	49 24.7%	43 21.7%	50 25.3%	4 2.0%	**8.14**	**+ 0.08**
	Wales	United Kingdom	51	1 2.0%	0 0.0%	1 2.0%	0 0.0%	4 7.8%	2 3.9%	12 23.5%	10 19.6%	1 2.0%	19 37.3%	2 3.9%		**+ 1.25**
61	Severozapaden (Northwestern)	Bulgaria	118	1 0.8%	2 1.7%	3 2.5%	2 1.7%	6 5.1%	8 6.8%	14 11.9%	16 13.6%	14 11.9%	49 41.5%	2 1.7%	**8.12**	**+ 0.47**
62	Stockholm County (Stockholms län)	Sweden	228	2 0.9%	0 0.0%	2 0.9%	5 2.2%	14 6.1%	4 1.8%	47 20.6%	48 21.1%	37 16.2%	68 29.8%	0 0.0%	**8.11**	**- 0.26**

Table D.7 – Overall European public's perception, in 2019, of how serious a problem they think climate change is currently, based upon NUTS1 regions (Continued)

No.	Region		*N*	1	2	3	4	5	6	7	8	9	10	Don't Know	Average	
63	Région Wallonne (Walloon Region)	Belgium	330	2 0.6%	1 0.3%	1 0.3%	4 1.2%	25 7.6%	18 5.5%	59 17.9%	69 20.9%	51 15.5%	99 30.0%	0 0.0%	**8.09**	**+ 0.41**
64	Niedersachsen (Lower Saxony)	Germany	153	1 0.7%	0 0.0%	3 2.0%	7 4.6%	7 4.6%	9 5.9%	32 20.9%	21 13.7%	22 14.4%	52 34.0%	0 0.0%	**8.08**	**+ 0.71**
65	Dél-Dunántúl (Southern Transdanubia)	Hungary	96	0 0.0%	0 0.0%	0 0.0%	0 0.0%	5 5.2%	8 8.3%	14 14.6%	20 20.8%	27 28.1%	20 20.8%	0 0.0%	**8.06**	**+ 0.20**
	South East England	United Kingdom	144	4 2.8%	3 2.1%	3 2.1%	1 0.7%	7 4.9%	9 6.3%	18 12.5%	22 15.3%	18 12.5%	56 38.9%	3 2.1%		**+ 0.79**
67	Sud-Ouest (South West)	France	105	1 1.0%	0 0.0%	1 1.0%	5 4.8%	7 6.7%	3 2.9%	16 15.2%	20 19.0%	11 10.5%	38 36.2%	2 1.9%	**8.04**	**- 0.24**
68	Yugoiztochen (Southeastern)	Bulgaria	153	3 2.0%	0 0.0%	3 2.0%	5 3.3%	10 6.5%	10 6.5%	19 12.4%	20 13.1%	22 14.4%	54 35.3%	7 4.6%	**8.03**	**+ 0.41**
	Border	Ireland	115	0 0.0%	1 0.9%	1 0.9%	3 2.6%	10 8.7%	7 6.1%	23 20.0%	22 19.1%	12 10.4%	37 32.2%	0 0.0%		**+ 1.36**
70	Centru (Centre)	Romania	123	0 0.0%	0 0.0%	3 2.4%	1 0.8%	9 7.3%	10 8.1%	14 11.4%	22 17.9%	16 13.0%	37 30.1%	10 8.1%	**8.02**	**- 0.41**
	London	United Kingdom	136	1 0.7%	1 0.7%	4 2.9%	3 2.2%	9 6.6%	5 3.7%	16 11.8%	31 22.8%	21 15.4%	44 32.4%	0 0.0%		**+ 0.33**
72	Saarland	Germany	19	0 0.0%	0 0.0%	1 5.3%	0 0.0%	2 10.5%	1 5.3%	3 15.8%	3 15.8%	2 10.5%	7 36.8%	0 0.0%	**8.00**	**- 0.16**
73	Hessen (Hesse)	Germany	118	4 3.4%	0 0.0%	0 0.0%	2 1.7%	14 11.9%	5 4.2%	8 6.8%	30 25.4%	15 12.7%	40 33.9%	0 0.0%	**7.99**	**+ 0.18**
	Panevėžio apskritis (Panevėžys County)	Lithuania	82	1 1.2%	0 0.0%	8 9.8%	1 1.2%	6 7.3%	6 7.3%	6 7.3%	15 18.3%	2 2.4%	38 46.3%	0 0.0%		**+ 0.43**
	Luxembourg	Luxembourg	502	14 2.8%	6 1.2%	15 3.0%	6 1.2%	39 7.8%	36 7.2%	45 9.0%	77 15.3%	47 9.4%	212 42.2%	4 0.8%		**+ 0.15**

Table D.7 – Overall European public's perception, in 2019, of how serious a problem they think climate change is currently, based upon NUTS1 regions (Continued)

No.	Region		*N*	1	2	3	4	5	6	7	8	9	10	Don't Know	Average	
76	Střední Čechy (Central Bohemia)	Czech Republic	125	1 0.8%	1 0.8%	2 1.6%	3 2.4%	10 8.0%	10 8.0%	17 13.6%	20 16.0%	10 8.0%	49 39.2%	1 0.8%	**7.98**	**+ 1.47**
	South-West	Ireland	157	0 0.0%	1 0.6%	0 0.0%	6 3.8%	14 8.9%	18 11.5%	23 14.6%	25 15.9%	18 11.5%	51 32.5%	2 1.3%		**+ 0.63**
78	East of England	United Kingdom	98	2 2.0%	0 0.0%	1 1.0%	2 2.0%	10 10.2%	10 10.2%	5 5.1%	21 21.4%	12 12.2%	33 33.7%	2 2.0%	**7.96**	**+ 0.54**
79	Východné Slovensko (Eastern Slovakia)	Slovakia	312	0 0.0%	1 0.3%	4 1.3%	5 1.6%	25 8.0%	30 9.6%	50 16.0%	64 20.5%	33 10.6%	91 29.2%	9 2.9%	**7.95**	**+ 0.41**
80	Yuzhen tsentralen (Southern Central)	Bulgaria	209	0 0.0%	0 0.0%	2 1.0%	4 1.9%	16 7.7%	21 10.0%	30 14.4%	44 21.1%	30 14.4%	52 24.9%	10 4.8%	**7.94**	**+ 0.52**
	Syddanmark (Southern Denmark)	Denmark	218	0 0.0%	1 0.5%	3 1.4%	6 2.8%	20 9.2%	18 8.3%	33 15.1%	41 18.8%	27 12.4%	67 30.7%	2 0.9%		**+ 0.10**
	Podravska (Drava)	Slovenia	160	1 0.6%	1 0.6%	1 0.6%	2 1.3%	11 6.9%	18 11.3%	23 14.4%	35 21.9%	17 10.6%	50 31.3%	0 0.0%		**- 0.03**
	Savinjska (Savinja)	Slovenia	126	5 4.0%	1 0.8%	2 1.6%	1 0.8%	9 7.1%	13 10.3%	8 6.3%	27 21.4%	12 9.5%	48 38.1%	0 0.0%		**- 0.39**
84	Südösterreich (Southern Austria)	Austria	217	1 0.5%	2 0.9%	6 2.8%	4 1.8%	19 8.8%	29 13.4%	25 11.5%	29 13.4%	7 3.2%	94 43.3%	0 0.0%	**7.92**	**+ 0.12**
85	Saxony-Anhalt (Sachsen-Anhalt)	Germany	43	0 0.0%	1 2.3%	0 0.0%	0 0.0%	3 7.0%	2 4.7%	7 16.3%	12 27.9%	4 9.3%	13 30.2%	0 0.0%	**7.91**	**- 0.04**
	Közép-Magyarország (Central Hungary)	Hungary	307	0 0.0%	3 1.0%	8 2.6%	3 1.0%	13 4.2%	24 7.8%	55 17.9%	67 21.8%	46 15.0%	78 25.4%	8 2.6%		**- 0.18**

Table D.7 – Overall European public’s perception, in 2019, of how serious a problem they think climate change is currently, based upon NUTS1 regions (Continued)

No.	Region		*N*	1	2	3	4	5	6	7	8	9	10	Don’t Know	Average	
87	Midtjylland (Central Jutland)	Denmark	231	1 0.4%	3 1.3%	10 4.3%	3 1.3%	24 10.4%	18 7.8%	28 12.1%	37 16.0%	32 13.9%	76 32.9%	1 0.4%	**7.90**	**+ 0.14**
	Saxony (Sachsen)	Germany	78	5 6.4%	0 0.0%	3 3.8%	0 0.0%	4 5.1%	3 3.8%	8 10.3%	14 17.9%	12 15.4%	28 35.9%	1 1.3%		**+ 1.98**
	Utenos Apskritis (Utena County)	Lithuania	50	0 0.0%	1 2.0%	0 0.0%	0 0.0%	6 12.0%	3 6.0%	4 8.0%	18 36.0%	7 14.0%	11 22.0%	0 0.0%		**+ 0.19**
	Sud – Muntenia (South – Muntenia)	Romania	164	0 0.0%	0 0.0%	3 1.8%	7 4.3%	24 14.6%	14 8.5%	12 7.3%	26 15.9%	18 11.0%	60 36.6%	0 0.0%		**+ 0.93**
	East Middle Sweden (Östra Mellansverige)	Sweden	173	3 1.7%	2 1.2%	3 1.7%	1 0.6%	17 9.8%	6 3.5%	27 15.6%	42 24.3%	20 11.6%	52 30.1%	0 0.0%		**+ 0.07**
92	Severozápad (Northwest)	Czech Republic	109	1 0.9%	0 0.0%	3 2.8%	4 3.7%	14 12.8%	8 7.3%	17 15.6%	10 9.2%	3 2.8%	49 45.0%	0 0.0%	**7.89**	**+ 0.85**
	West Midlands	United Kingdom	92	1 1.1%	1 1.1%	1 1.1%	5 5.4%	4 4.3%	7 7.6%	11 12.0%	21 22.8%	7 7.6%	33 35.9%	0 0.0%		**+ 0.12**
94	Nord-Pas-de-Calais (North and Strait of Calais)	France	65	1 1.5%	0 0.0%	0 0.0%	1 1.5%	5 7.7%	5 7.7%	14 21.5%	13 20.0%	10 15.4%	16 24.6%	0 0.0%	**7.88**	**- 0.83**
	Stredné Slovensko (Central Slovakia)	Slovakia	268	1 0.4%	3 1.1%	1 0.4%	7 2.6%	31 11.6%	17 6.3%	30 11.2%	52 19.4%	63 23.5%	60 22.4%	3 1.1%		**= 0.00**
96	North Netherlands (Noord-Nederland)	Netherlands	105	0 0.0%	0 0.0%	1 1.0%	0 0.0%	6 5.7%	17 16.2%	14 13.3%	30 28.6%	17 16.2%	20 19.0%	0 0.0%	**7.87**	**+ 0.40**
97	Dublin	Ireland	301	4 1.3%	4 1.3%	3 1.0%	3 1.0%	33 11.0%	19 6.3%	42 14.0%	68 22.6%	39 13.0%	84 37.9%	1 0.3%	**7.80**	**+ 0.18**
98	Westösterreich (Western Austria)	Austria	374	7 1.9%	3 0.8%	14 3.7%	12 3.2%	21 5.6%	24 6.4%	55 14.7%	84 22.5%	40 10.7%	113 30.2%	2 0.5%	**7.79**	**+ 0.29**
	Southeast (Jihovýchod)	Czech Republic	163	0 0.0%	0 0.0%	9 5.5%	3 1.8%	18 11.0%	10 6.1%	27 16.6%	21 12.9%	12 7.4%	60 36.8%	2 1.2%		**+ 0.61**

Table D.7 – Overall European public's perception, in 2019, of how serious a problem they think climate change is currently, based upon NUTS1 regions (Continued)

No.	Region		*N*	1	2	3	4	5	6	7	8	9	10	Don't Know	Average	
100	Etelä-Suomi (South Finland)	Finland	219	2 0.9%	0 0.0%	6 2.7%	11 5.0%	14 6.4%	8 3.7%	34 15.5%	55 25.1%	37 16.9%	48 21.9%	4 1.8%	7.78	+ 0.26
	Vest (West)	Romania	97	2 2.1%	0 0.0%	2 2.1%	0 0.0%	4 4.1%	8 8.2%	24 24.7%	20 20.6%	15 15.5%	20 20.6%	2 2.1%		+ 0.18
102	Northeast (Severovýchod)	Czech Republic	146	0 0.0%	0 0.0%	4 2.7%	1 0.7%	19 13.0%	11 7.5%	24 16.4%	27 18.5%	22 15.1%	36 24.7%	2 1.4%	7.77	+ 0.87
103	Północno-Zachodni	Poland	163	1 0.6%	4 2.5%	0 0.0%	7 4.3%	9 5.5%	15 9.2%	24 14.7%	36 22.1%	35 21.5%	32 19.6%	0 0.0%	7.75	+ 0.42
	Západné Slovensko (Western Slovakia)	Slovakia	373	1 0.3%	0 0.0%	0 0.0%	3 0.8%	29 7.8%	37 9.9%	98 26.3%	77 20.6%	58 15.5%	64 17.2%	6 1.6%		+ 0.43
105	Méditerranée (Mediterranean)	France	128	2 1.6%	4 3.1%	5 3.9%	4 3.1%	10 7.8%	4 3.1%	15 11.7%	21 16.4%	21 16.4%	39 30.5%	3 2.3%	7.74	- 0.66
	Kontinentalna Hrvatska (Continental Croatia)	Croatia	696	5 0.7%	6 0.9%	14 2.0%	26 3.7%	65 9.3%	70 10.1%	97 13.9%	123 17.7%	83 11.9%	203 29.2%	5 0.7%		- 0.07
	Thuringia (Thüringen)	Germany	42	0 0.0%	0 0.0%	0 0.0%	0 0.0%	3 7.1%	5 11.9%	9 21.4%	15 35.7%	3 7.1%	7 16.7%	0 0.0%		+ 0.19
108	Praha (Prague)	Czech Republic	121	0 0.0%	0 0.0%	0 0.0%	4 3.3%	6 5.0%	14 11.6%	25 20.7%	32 26.4%	14 11.6%	24 19.8%	1 0.8%	7.73	+ 0.90
109	Est (East)	France	89	3 3.4%	0 0.0%	3 3.4%	1 1.1%	8 9.0%	5 5.6%	20 22.5%	10 11.2%	9 10.1%	30 33.7%	0 0.0%	7.72	- 0.55
	Klaipėdos apskritis (Klaipėda County)	Lithuania	111	3 2.7%	0 0.0%	1 0.9%	2 1.8%	14 12.6%	10 9.0%	9 8.1%	31 27.9%	8 7.2%	33 29.7%	0 0.0%		- 0.12
111	North Middle Sweden (Norra Mellansverige)	Sweden	90	0 0.0%	2 2.2%	0 0.0%	0 0.0%	14 15.6%	1 1.1%	14 15.6%	24 26.7%	19 21.1%	15 16.7%	0 0.0%	7.68	+ 0.16

Table D.7 – Overall European public's perception, in 2019, of how serious a problem they think climate change is currently, based upon NUTS1 regions (Continued)

No.	Region		*N*	1	2	3	4	5	6	7	8	9	10	Don't Know	Average	
112	Berlin	Germany	67	0 0.0%	0 0.0%	1 1.5%	3 4.5%	10 14.9%	3 4.5%	6 9.0%	12 17.9%	6 9.0%	23 34.3%	1 1.5%	7.65	- 0.51
	Północny	Poland	152	1 0.7%	0 0.0%	5 3.3%	1 0.7%	19 12.5%	12 7.9%	17 11.2%	33 21.7%	24 15.8%	30 19.7%	10 6.6%		+ 0.92
	Nord-Vest (North West)	Romania	136	2 1.5%	0 0.0%	1 0.7%	1 0.7%	13 9.6%	21 15.4%	18 13.2%	16 11.8%	12 8.8%	31 22.8%	22 16.2%		- 0.12
	Bratislavský (Bratislava Region)	Slovakia	124	0 0.0%	0 0.0%	0 0.0%	2 1.6%	10 8.1%	11 8.9%	27 21.8%	39 31.5%	16 12.9%	18 14.5%	0 0.0%		+ 0.39
116	Gorenjska (Upper Carniola)	Slovenia	98	0 0.0%	0 0.0%	2 2.0%	2 2.0%	9 9.2%	11 1.2%	15 15.3%	30 30.6%	11 11.2%	18 18.4%	0 0.0%	7.64	
117	Telšių apskritis (Telšiai County)	Lithuania	49	2 4.1%	1 2.0%	1 2.0%	0 0.0%	13 26.5%	1 2.0%	5 10.2%	5 10.2%	7 14.3%	15 30.6%	1 2.0%	7.63	+ 0.38
118	București – Ilfov (Bucharest – Ilfov)	Romania	123	0 0.0%	0 0.0%	1 0.8%	4 3.3%	13 10.6%	14 11.4%	18 14.6%	23 18.7%	13 10.6%	22 17.9%	16 13.0%	7.62	- 0.22
	Osrednjeslovenska (Central Slovenia)	Slovenia	263	11 4.2%	3 1.1%	4 1.5%	2 0.8%	14 5.3%	26 9.9%	44 16.7%	57 21.7%	28 10.6%	71 27.0%	2 0.8%		+ 0.03
120	North West England	United Kingdom	116	7 6.0%	1 0.9%	5 4.3%	1 0.9%	7 6.0%	12 10.3%	14 12.1%	19 16.4%	10 8.6%	40 34.5%	1 0.9%	7.61	+ 0.55
121	Marijampolės apskritis (Marijampolė County)	Lithuania	52	3 5.8%	0 0.0%	1 1.9%	2 3.8%	4 7.7%	3 5.8%	12 23.1%	7 13.5%	7 13.5%	14 26.9%	0 0.0%	7.60	+ 0.16
	Pomurska (Mura)	Slovenia	58	1 1.7%	0 0.0%	1 1.7%	2 3.4%	5 8.6%	5 8.6%	14 24.1%	8 13.8%	8 13.8%	14 24.1%	0 0.0%		+ 0.79
123	Šiaulių apskritis (Šiauliai County)	Lithuania	98	2 2.0%	0 0.0%	0 0.0%	0 0.0%	14 14.3%	9 9.2%	17 17.3%	18 18.4%	16 16.3%	21 21.4%	0 0.0%	7.58	- 0.07
124	Sud-Vest Oltenia (South-West Oltenia)	Romania	109	4 3.7%	0 0.0%	2 1.8%	3 2.8%	7 6.4%	10 9.2%	11 10.1%	19 17.4%	21 19.3%	26 23.9%	4 3.7%	7.57	+ 0.06

Table D.7 – Overall European public's perception, in 2019, of how serious a problem they think climate change is currently, based upon NUTS1 regions (Continued)

No.	Region		*N*	1	2	3	4	5	6	7	8	9	10	Don't Know	Average	
125	Região do Centro (Central Region)	Portugal	236	0 0.0%	0 0.0%	1 0.4%	6 2.5%	2 0.8%	27 11.4%	71 30.1%	78 33.1%	39 16.5%	9 3.8%	3 1.3%	**7.56**	- 0.22
126	Sud-Est (South East)	Romania	132	0 0.0%	0 0.0%	3 2.3%	8 6.1%	18 13.6%	22 16.7%	11 8.3%	7 5.3%	17 12.9%	41 31.1%	5 3.8%	**7.55**	- 0.07
127	Scotland	United Kingdom	89	3 3.4%	1 1.1%	2 2.2%	1 1.1%	11 12.4%	7 7.9%	16 18.0%	12 13.5%	9 10.1%	27 30.3%	0 0.0%	**7.54**	+ 0.75
128	Jadranska Hrvatska (Adriatic Croatia)	Croatia	320	4 1.3%	3 0.9%	9 2.8%	10 3.1%	35 10.9%	32 10.0%	48 15.0%	68 21.3%	35 10.9%	73 22.8%	4 1.3%	**7.50**	+ 0.59
129	Południowy	Poland	210	7 3.3%	1 0.5%	5 2.4%	4 1.9%	20 9.5%	20 9.5%	31 14.8%	43 20.5%	8 3.8%	62 29.5%	8 3.8%	**7.49**	+ 0.39
	Wschodni	Poland	177	2 1.1%	0 0.0%	2 1.1%	3 1.7%	28 15.8%	20 11.3%	25 14.1%	28 15.8%	10 5.6%	49 27.7%	9 5.1%		+ 0.36
131	Mid-West	Ireland	88	0 0.0%	0 0.0%	0 0.0%	1 1.1%	10 11.4%	7 8.0%	18 20.5%	29 33.0%	17 19.3%	5 5.7%	0 0.0%	**7.47**	+ 0.62
	Kauno apskritis (Kaunas County)	Lithuania	200	4 2.0%	3 1.5%	8 4.0%	8 4.0%	21 10.5%	20 10.0%	19 9.5%	37 18.5%	28 14.0%	50 25.0%	3 1.5%		- 0.15
133	West	Ireland	101	5 5.0%	0 0.0%	1 1.0%	1 1.0%	13 12.9%	26 25.7%	12 11.9%	4 4.0%	3 3.0%	37 36.6%	1 1.0%	**7.46**	- 0.33
134	Vlaams Gewest (Flemish Region)	Belgium	591	4 0.7%	6 1.0%	7 1.2%	10 1.7%	56 9.5%	85 14.4%	142 24.0%	109 18.4%	57 9.6%	115 19.5%	1 0.2%	**7.45**	- 0.01
	South Netherlands (Zuid-Nederland)	Netherlands	222	5 2.3%	1 0.5%	2 0.9%	9 4.1%	20 9.0%	14 6.3%	60 27.0%	48 21.6%	26 11.7%	36 16.2%	3 1.4%		- 0.19
136	Vilniaus apskritis (Vilnius County)	Lithuania	272	4 1.5%	9 3.3%	6 2.2%	11 4.0%	27 9.9%	17 6.3%	40 14.7%	63 23.2%	31 11.4%	63 23.2%	1 0.4%	**7.43**	- 0.12
	Yorkshire and The Humber	United Kingdom	88	3 3.4%	0 0.0%	2 2.3%	1 1.1%	16 18.2%	5 5.7%	10 11.4%	21 23.9%	5 5.7%	24 27.3%	1 1.1%		+ 0.91

Table D.7 – Overall European public's perception, in 2019, of how serious a problem they think climate change is currently, based upon NUTS1 regions (Continued)

No.	Region		*N*	1	2	3	4	5	6	7	8	9	10	Don't Know	Average	
138	Brandenburg	Germany	47	1 2.1%	0 0.0%	1 2.1%	0 0.0%	7 14.9%	2 4.3%	7 14.9%	10 21.3%	2 4.3%	15 31.9%	0 0.0%	**7.40**	**- 0.45**
139	Upper Norrland (Övre Norrland)	Sweden	56	2 3.6%	0 0.0%	0 0.0%	0 0.0%	8 14.3%	8 14.3%	5 8.9%	18 32.1%	6 10.7%	9 16.1%	0 0.0%	**7.38**	**- 0.12**
140	East Netherlands (Oost-Nederland)	Netherlands	214	7 3.3%	2 0.9%	4 1.9%	3 1.4%	18 8.4%	16 7.5%	28 13.1%	86 40.2%	19 8.9%	30 14.0%	0 0.0%	**7.36**	**- 0.06**
	Centralny	Poland	208	4 1.9%	0 0.0%	3 1.4%	3 1.4%	21 10.1%	26 12.5%	39 18.8%	41 19.7%	20 9.6%	36 17.3%	14 6.7%		**+ 0.73**
142	Riga (Rīga)	Latvia	325	10 3.1%	3 0.9%	4 1.2%	10 3.1%	42 12.9%	32 9.8%	47 14.5%	78 24.0%	26 8.0%	71 21.8%	3 0.9%	**7.35**	**+ 0.50**
143	North East England	United Kingdom	43	2 4.7%	0 0.0%	1 2.3%	2 4.7%	6 14.0%	7 16.3%	3 7.0%	4 9.3%	3 7.0%	15 34.9%	0 0.0%	**7.33**	**- 0.04**
144	West Netherlands (West-Nederland)	Netherlands	481	11 2.3%	3 0.6%	6 1.2%	14 2.9%	57 11.9%	42 8.7%	99 20.6%	119 24.7%	54 11.2%	76 15.8%	0 0.0%	**7.32**	**- 0.30**
145	Moravskoslezsko (Moravian-Silesian)	Czech Republic	119	2 1.7%	0 0.0%	4 3.4%	6 5.0%	14 11.8%	16 13.4%	17 14.3%	15 12.6%	14 11.8%	27 22.7%	4 3.4%	**7.30**	**+ 0.41**
146	Pohjois- ja Itä-Suomi (North and East Finland)	Finland	240	4 1.7%	10 4.2%	11 4.6%	9 3.8%	19 7.9%	23 9.6%	31 12.9%	60 25.0%	39 16.3%	36 15.0%	0 0.0%	**7.23**	**= 0.00**
	Italia insulare (Insular Italy)	Italy	115	2 1.7%	5 4.3%	3 2.6%	7 6.1%	6 5.2%	21 18.3%	11 9.6%	14 12.2%	14 12.2%	29 25.2%	3 2.6%		**- 0.90**
	Alytaus apskritis (Alytus County)	Lithuania	52	1 1.9%	0 0.0%	0 0.0%	1 1.9%	5 9.6%	8 15.4%	9 17.3%	14 26.9%	7 13.5%	6 11.5%	0 0.0%		**+ 0.92**
149	Länsi-Suomi (West Finland)	Finland	255	2 0.8%	8 3.1%	9 3.5%	9 3.5%	20 7.8%	31 12.2%	42 16.5%	66 25.9%	35 13.7%	33 12.9%	1 0.4%	**7.22**	**- 0.07**
150	Põhja-Eesti (Northern Estonia)	Estonia	431	16 3.7%	9 2.1%	15 3.5%	13 3.0%	44 10.2%	46 10.7%	61 14.2%	91 21.1%	36 8.4%	94 21.8%	6 1.4%	**7.17**	**+ 0.90**

Table D.7 – Overall European public's perception, in 2019, of how serious a problem they think climate change is currently, based upon NUTS1 regions (Continued)

No.	Region		*N*	1	2	3	4	5	6	7	8	9	10	Don't Know	Average	
151	Midland	Ireland	66	0 0.0%	0 0.0%	0 0.0%	0 0.0%	9 13.6%	14 21.2%	15 22.7%	12 18.2%	8 12.1%	4 6.1%	4 6.1%	**7.13**	**- 0.24**
152	Jihozápad (Southwest)	Czech Republic	117	3 2.6%	2 1.7%	6 5.1%	4 3.4%	17 14.5%	5 4.3%	17 14.5%	24 20.5%	13 11.1%	24 20.5%	1 0.9%	**7.10**	**+ 0.66**
153	Spodnjeposavska (Lower Sava)	Slovenia	34	1 2.9%	1 2.9%	0 0.0%	1 2.9%	2 5.9%	5 14.7%	5 14.7%	7 20.6%	4 11.8%	6 17.6%	1 2.9%	**7.09**	**- 0.03**
154	Ostösterreich (Eastern Austria)	Austria	448	20 4.5%	12 2.7%	25 5.6%	26 5.8%	37 8.3%	32 7.1%	60 13.4%	77 17.2%	47 10.5%	107 23.9%	6 1.3%	**7.08**	**- 0.01**
155	Nisia Aigaiou, Kriti (Aegean Islands, Crete)	Greece	63	0 0.0%	0 0.0%	5 7.9%	6 9.5%	7 11.1%	5 7.9%	8 12.7%	14 22.2%	8 12.7%	10 15.9%	0 0.0%	**7.05**	**= 0.00**
156	East Midlands	United Kingdom	76	4 5.3%	1 1.3%	3 3.9%	4 5.3%	8 10.5%	3 3.9%	18 23.7%	11 14.5%	8 10.5%	15 19.7%	1 1.3%	**7.00**	**+ 0.05**
157	Latgale (Latgola)	Latvia	146	4 2.7%	5 3.4%	4 2.7%	4 2.7%	24 16.4%	15 10.3%	23 15.8%	23 15.8%	8 5.5%	30 20.5%	6 4.1%	**6.92**	**- 0.31**
158	Pieriga (Pierīga)	Latvia	180	4 2.2%	0 0.0%	4 2.2%	7 3.9%	27 15.0%	36 20.0%	34 18.9%	25 13.9%	15 8.3%	26 14.4%	2 1.1%	**6.90**	**+ 0.56**
	Nord-Est (North East)	Romania	168	5 3.0%	1 0.6%	6 3.6%	7 4.2%	18 10.7%	29 17.3%	37 22.0%	18 10.7%	11 6.5%	34 20.2%	0 0.0%		**- 0.39**
160	Central Moravia (Střední Morava)	Czech Republic	119	4 3.4%	2 1.7%	6 5.0%	3 2.5%	20 16.8%	9 7.6%	27 22.7%	17 14.3%	6 5.0%	22 18.5%	1 0.8%	**6.70**	**+ 0.19**
	Kurzeme	Latvia	128	3 2.3%	3 2.3%	5 3.9%	7 5.5%	19 14.8%	18 14.1%	29 22.7%	24 18.8%	6 4.7%	14 10.9%	2 1.6%		**+ 0.75**
162	Zemgale	Latvia	122	6 4.9%	1 0.8%	6 4.9%	6 4.9%	23 18.9%	13 10.7%	16 13.1%	21 17.2%	4 3.3%	24 19.7%	2 1.6%	**6.66**	**+ 0.46**
163	North-Eastern Estonia (Kirde-Eesti)	Estonia	114	5 4.4%	3 2.6%	1 0.9%	1 0.9%	23 20.2%	14 12.3%	23 20.2%	17 14.9%	4 3.5%	17 14.9%	5 4.4%	**6.61**	**- 0.09**

Table D.7 – Overall European public's perception, in 2019, of how serious a problem they think climate change is currently, based upon NUTS1 regions (Continued)

No.	Region		*N*	1	2	3	4	5	6	7	8	9	10	Don't Know	Average*	
164	Kesk-Eesti (Central Estonia)	Estonia	96	6 6.3%	2 2.1%	0 0.0%	3 3.1%	17 17.7%	9 9.4%	23 24.0%	13 13.5%	6 6.3%	14 14.6%	2 2.1%	**6.60**	**- 0.04**
165	Lõuna-Eesti (Southern Estonia)	Estonia	246	14 5.7%	9 3.7%	14 5.7%	8 3.3%	35 14.2%	24 9.8%	44 17.9%	39 15.9%	17 6.9%	36 14.6%	6 2.4%	**6.49**	**+ 0.04**
166	Mecklenburg- Vorpommern	Germany	31	2 6.5%	1 3.2%	2 6.5%	2 6.5%	5 16.1%	2 6.5%	5 16.1%	3 9.7%	3 9.7%	4 12.9%	3 9.7%	**6.46**	**- 0.86**
167	Bruxelles (Brussels)	Belgium	108	2 1.9%	0 0.0%	5 4.6%	13 12.0%	24 22.2%	15 139.%	10 9.3%	16 14.8%	10 9.3%	13 12.0%	0 0.0%	**6.45**	**- 0.48**
	Obalno-kraška (Coastal-Karst)	Slovenia	56	8 14.3%	2 3.6%	3 5.4%	1 1.8%	3 5.4%	4 7.1%	2 3.6%	5 8.9%	9 16.1%	13 23.2%	5 8.9%		**- 0.99**
169	Lääne-Eesti (Western Estonia)	Estonia	112	4 3.6%	4 3.6%	2 1.8%	5 4.5%	25 22.3%	14 12.5%	16 14.3%	18 16.1%	2 1.8%	18 16.1%	3 2.7%	**6.43**	**+ 0.90**
170	Vidzeme	Latvia	102	6 5.9%	2 2.0%	2 2.0%	4 3.9%	24 23.5%	13 12.7%	16 15.7%	16 15.7%	6 5.9%	12 11.8%	1 1.0%	**6.38**	**+ 0.10**

No. = Number; *N* = Number of Respondents; Note: All Percentages might not add up to 100 per cent due to rounding errors

***N* = 27,299**

Source: Data Adapted from Eurobarometer (2019)

Appendix E – Greenhouse Gas Emissions in the Atmosphere

Table E.1 – Quantity of greenhouse gas emissions in 2005 and 2011, in ppt, and the GWP of these gases over 100 years

Greenhouse Gas		**Parts per Trillion (ppt)**				**GWP over 100 years [AR5]**
		2005	**2011**	**Change**		
Water Vapour (H_2O)		18,000,000,000			-	-
Carbon Dioxide (CO_2)		379,000,000	391,000,000		+3.2%	1
Methane (CH_4)		1,774,000	1,893,000		+6.7%	25-34
Nitrous Oxide (N_2O)		319,000	324,000	+5,000	+1.6%	298
Ozone (O_3)		337,000			-	-
Sulfuryl Fluoride (SO_2F_2)		1.35	1.71	+0.36	+26.7%	4,000-5,000
1,1,1-Trichloroethane (Ch_3CCl_3)		18.32	6.32	-12.00	-65.5%	124
Carbon Tetrachloride (CCl_4)		93.1	85.8	-7.3	-7.8%	1,730
Chlorofluorocarbons [CFCs]	Trichloroflurомethane [CFC-11] (CCl_3F)	251	238	-13	-5.2%	4,660
	Dichlorodifluoromethane [CFC-12] (CCl_2F_2)	542	528	-14	-2.6%	10,200
	Chlorotrifluoromethane [CFC-13] ($CClF_3$)	-	2.7	-	-	13,900
	1,1,2-Trichlorotrifluoroethane [CFC-113] ($C_2Cl_3F_3$)	78.6	74.3	-4.3	-5.5%	5,820
	Chloropentafluoroethane [CFC-115] (C_2ClF_5)	8.36	8.37	+0.01	+0.1%	7,670
Hydrochlorofluorocarbons [HCFCs]	Chlorodifluoromethane [HCFC-22] ($CHClF_2$)	169	213	+44	+26.0%	1,760
	1,1-Dichloro-1-fluoroethane [HCFC-141b] ($C_2H_3Cl_2F$)	17.7	21.4	+3.7	+20.9%	782
	1-Chloro-1,1-difluoroethane [HCFC-142b] ($C_2H_3ClF_2$)	15.5	21.2	+5.7	+36.8%	1,980
Hydrofluorocarbons [HFCs]	Fluoroform [HFC-23] (CHF_3)	18.8	24.0	+5.2	+27.7%	12,400
	Difluoromethane [HFC-32] (CH_2F_2)	1.15	4.92	+3.77	+327.8%	677
	Pentafluoroethane [HFC-125] (C_2HF_5)	3.69	9.58	+5.89	+159.6%	3,170
	1,1,1,2-Tetrafluoroethane [HFC-134a] (CF_3CH_2F)	34.3	62.7	+28.4	+82.8%	1,300
	1,1,1-Trifluoroethane [HFC-143a] ($C_2H_3F_3$)	5.6	12.0	+6.4	+114.3%	4,800
	1,1-Difluoroethane [HFC-152a]	3.4	6.4	+3.0	+88.2%	138
Perfluorocarbons [PFCs]	Sulfur Hexafluoride (SF_6)	5.64	7.28	+1.64	+29.1%	23,500
	Nitrogen Trifluoride (NF_3)	0.4	0.9	+0.5	+125.0%	16,100
	Carbon Tetrafluoride (CF_4)	75.0	79.0	+4.0	+5.3%	6,630
	Hexafluoroethane (C_2F_6)	3.66	4.16	+0.5	+13.7%	11,100

Source: Adapted from Papadimitriou *et al.* (2008); Andersen *et al.,* (2009); Mühle *et al.* (2009); Myhre et al. (2013); and EPA (No Date)

Appendix F – Annual Global Carbon Dioxide Emissions

Table F.1 – Annual Average of CO^2 Emissions Recorded at Mauna Loa, Hawaii, United States

Year	CO^2 Emissions (ppm)	Change	Per cent change Year on Year	Year	CO^2 Emissions (ppm)	Change	Per cent change Year on Year
1959	315.97			**1990**	354.39	+ 1.27	↑ 12.16%
1960	316.91	+ 0.94	↑ 0.30%	**1991**	355.61	+ 1.22	↑ 12.55%
1961	317.64	+ 0.73	↑ 0.53%	**1992**	356.45	+ 0.84	↑ 12.81%
1962	318.45	+ 0.81	↑ 0.78%	**1993**	357.10	+ 0.65	↑ 13.02%
1963	318.99	+ 0.54	↑ 0.96%	**1994**	358.83	+ 1.73	↑ 13.56%
1964	319.62	+ 0.63	↑ 1.16%	**1995**	360.82	+ 1.99	↑ 14.19%
1965	320.04	+ 0.42	↑ 1.29%	**1996**	362.61	+ 1.79	↑ 14.76%
1966	321.38	+ 1.34	↑ 1.71%	**1997**	363.73	+ 1.12	↑ 15.12%
1967	322.16	+ 0.78	↑ 1.96%	**1998**	366.70	+ 2.97	↑ 16.06%
1968	323.04	+ 0.88	↑ 2.24%	**1999**	368.38	+ 1.68	↑ 16.59%
1969	324.62	+ 1.58	↑ 2.74%	**2000**	369.55	+ 1.17	↑ 16.96%
1970	325.68	+ 1.06	↑ 3.07%	**2001**	371.14	+ 1.59	↑ 17.46%
1971	326.32	+ 0.64	↑ 3.28%	**2002**	373.28	+ 2.14	↑ 18.14%
1972	327.45	+ 1.13	↑ 3.63%	**2003**	375.80	+ 2.52	↑ 18.94%
1973	329.68	+ 2.23	↑ 4.34%	**2004**	377.52	+ 1.72	↑ 19.48%
1974	330.18	+ 0.50	↑ 4.50%	**2005**	379.80	+ 2.28	↑ 20.20%
1975	331.11	+ 0.93	↑ 4.79%	**2006**	381.90	+ 2.10	↑ 20.87%
1976	332.04	+ 0.93	↑ 5.09%	**2007**	383.79	+ 1.89	↑ 21.46%
1977	333.83	+ 1.79	↑ 5.65%	**2008**	385.60	+ 1.81	↑ 22.04%
1978	335.40	+ 1.57	↑ 6.15%	**2009**	387.43	+ 1.83	↑ 22.62%
1979	336.84	+ 1.44	↑ 6.61%	**2010**	389.90	+ 2.47	↑ 23.40%
1980	338.75	+ 1.91	↑ 7.21%	**2011**	391.65	+ 1.75	↑ 23.95%
1981	340.11	+ 1.36	↑ 7.64%	**2012**	393.85	+ 2.20	↑ 24.65%
1982	341.45	+ 1.34	↑ 8.06%	**2013**	396.52	+ 2.67	↑ 25.49%
1983	343.05	+ 1.60	↑ 8.57%	**2014**	398.65	+ 2.13	↑ 26.17%
1984	344.65	+ 1.60	↑ 9.08%	**2015**	400.83	+ 2.18	↑ 26.86%
1985	346.12	+ 1.47	↑ 9.54%	**2016**	404.24	+ 3.41	↑ 27.94%
1986	347.42	+ 1.30	↑ 9.95%	**2017**	406.55	+ 2.31	↑ 28.67%
1987	349.19	+ 1.77	↑ 10.51%	**2018**	408.52	+ 1.97	↑ 29.29%
1988	351.57	+ 2.38	↑ 11.27%	**2019**	411.43	+ 2.91	↑ 30.21%
1989	353.12	+ 1.55	↑ 11.76%				

Source: Data Adapted from NOAA (2020)

Appendix G – Atlantic Thermohaline Circulation

The Atlantic thermohaline circulation, also known as a Gulf Stream, is the movement of the ocean from the Caribbean Sea to the Nordic Sea (Broecker, 1991). This circulation is driven by temperature (thermo) and salt (haline) forcing over the surface of the ocean (Stommel, 1961; Holden, 2008b). However, the melting of Arctic sea ice can reduce the intensity of the Gulf Stream (Vellinga and Wood, 2002; Sévellec, Fedorov and Liu, 2017). This is because the influx of freshwater from this ice and increasing precipitation that occurs in warmer climates can interfere with Atlantic thermohaline circulation. This is done as the evaporation of the ocean water in increased levels of salinity of the North Atlantic Ocean, but it also cools the ocean. This action causes the water to become heavy, and will sink (NSIDC, No Date). After the dense water sinks it travels in a southerly direction back to the Caribbean, as demonstrated in Figure G.1. This process is known as the 'Atlantic Meridional Overturn Circulation' (Bryden, Longworth and Cunningham, 2005).

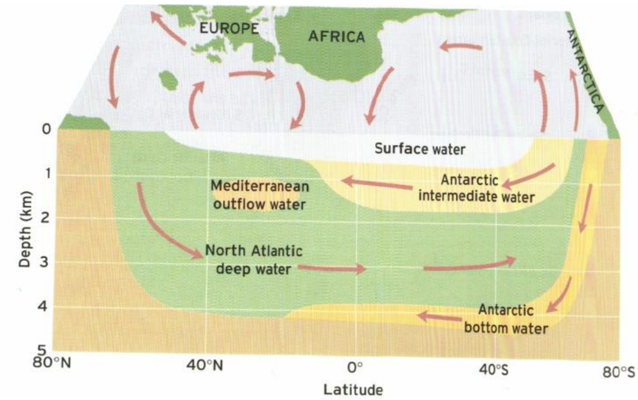

Figure G.1 – The vertical structures of water bodies within the Atlantic Ocean (Krom, 2008, p.62)

Therefore, the freshwater entering this loopback cycle will mean that there will be a decline in the strength of the Gulf Stream. It was noted by British researchers that at the northern part of the Gulf stream strength has decreased by 30 per cent between 1957 and 2004 (Bryden, Longworth and Cunningham, 2005); with further evidence to suggest that in the last 200 years, the intensity of the Gulf Stream has decline between 15 and 20 per cent overall (Rahmstorf *et al.*, 2015). Further research conducted by Caesar *et al.* (2018) that demonstrates that the Atlantic meridional overturning circulation is at its weakest for over 1,000 years.

It has been predicted by Wood, Vellinga and Thorpe (2003) that the complete collapse of the Atlantic thermohaline circulation would result in temperatures within Scandinavia and the United Kingdom to be between one and three degrees Celsius cooler, with cooling of up to twelve degrees Celsius in northern Norway. In addition, it is expected by Vellinga and Wood (2008) that precipitation in the Northern Hemisphere would decline, with the largest decline in the high latitudes. Similar events have occurred previously during the Younger Dryas[63] and the Heinrich event[64] (Boyle and Keigwin, 1987; Stouffer *et al.,* 2006; Lynch-Stieglitz, 2017).

[63] - The Younger Dryas was an abrupt climate change event that occurred c.12,900 to c.11,600 years ago (Rasmussen *et al.,* 2006; Carlson, 2010), and is a time when the climate underwent a short and significant cold event (Holden, 2008a); with temperatures in Greenland declining by between 4^{o}C and 10^{o}C (Buizert *et al.*, 2014).

[64] - The Heinrich event was a phenomenon of global environment change due to the iceberg's breaking from the Laurentide Ice Sheet, based on the North American continent (MacAyeal, 1993).

Appendix H – List of Powering Past Coal Alliance States

Table H.1 – List of National Governments that are members of the 'Powering Past Coal Alliance'

National Governments			
Angola	Finland	Lithuania	Portugal
Austria	France	Luxembourg	Senegal
Belgium	Germany	Marshall Islands	Slovakia
Canada	Greece	Mexico	Sweden
Costa Rica	Ireland	Netherlands	Switzerland
Denmark	Israel	New Zealand	Tuvalu
El Salvador	Italy	Niue	United Kingdom
Ethiopia	Latvia	Peru	Vanuatu
Fiji	Liechtenstein		

Source: PPCA (No Date)

Table H.2 – List of Sub-national Governments that are members of the 'Powering Past Coal Alliance'

Sub-national Governments	
Alberta, Canada [Province]	New Jersey, United States [State]
Australian Capital Territory, Australia [Federal Territory]	New Taipei City, Taiwan [City]
	New York, United States [State]
Baden-Württemberg, Germany [State]	Ontario, Canada [Province]
Balearic Islands, Spain [Autonomous Community]	Oregon, United States [State]
British Columbia, Canada [Province]	Philadelphia, United states [City]
California, United States [State]	Puerto Rico [Unincorporated Territory]
Connecticut, United States [State]	Quebec, Canada [Province]
Gyeonggi, South Korea [Province]	Rotterdam, Netherlands [City]
Hawaii, United States [State]	Scotland, United Kingdom [Country]
Honolulu, United States [City]	Seoul, South Korea [City]
Ilocos Norte, Philippines [Province]	South Chungcheong, South Korea [Province]
Kaohsiung City, Taiwan [City]	Sydney, Australia [City]
Los Angeles, United States [City]	Taichung City, Taiwan [City]
Melbourne, Australia [City]	Vancouver, Canada [City]
Minnesota, United States [State]	Wales, United Kingdom [Country]
Negros Oriental, Philippines [Province]	Washington, United States [State]

Source: PPCA (No Date)

Appendix I – OECD and EU countries

Table I.1 – List of OECD and EU countries

EU Only Countries	OECD Only Countries	Both EU and OECD Countries
Croatia	Australia	Austria
Cyprus	Canada	Belgium
Malta	Chile	Czech Republic
Romania	Colombia	Denmark
	Iceland	Estonia
	Israel	Finland
	Japan	France
	Mexico	Germany
	New Zealand	Greece
	Norway	Hungary
	South Korea	Ireland
	Switzerland	Italy
	Turkey	Latvia
	United Kingdom	Lithuania
	United States	Luxembourg
		Netherlands
		Poland
		Portugal
		Slovakia
		Slovenia
		Spain
		Sweden

Appendix J – European Union's Greenhouse Gas Emissions Targets for Kyoto Protocol

Table J.1 – List of EU-15 Countries Kyoto Protocol Targets compared to Actual Emission Reductions

Countries	Kyoto Target [2008-2012] Compared to Baseline Year	GHG [2012] (EEA, 2014) Compared to Baseline Year	Target Met
Austria	-13%	+1.3%	X
Belgium	-7.5%	-20%	✓
Denmark	-21%	-25.5%	✓
Finland	0%	-14.1%	✓
France	0%	-13.1%	✓
Germany	-21%	-23.8%	✓
Greece	+25%	+3.7%	✓
Ireland	+13%	+5.3%	✓
Italy	-6.5%	-11%	✓
Luxembourg	-28%	-10.1%	X
Netherlands	-6%	-10%	✓
Portugal	+27%	+14.3%	✓
Spain	+15%	+17.6%	X
Sweden	+4%	-20.2%	✓
United Kingdom	-12.5%	-25.2%	✓
EU-15	**-8%**	**-15.1%**	✓

Table J.2 – Newly Joined EU Countries Kyoto Protocol Targets compared to Actual Emission Reductions

Countries	Kyoto Target [2008-2012] Compared to Baseline Year	GHG [2012] (EEA, 2014) Compared to Baseline Year	Target Met
Bulgaria	-8%	-54%	✓
Croatia	-5%	-15.7%	✓
Cyprus	N/A	N/A	✓
Czech Republic	-8%	-32.3%	✓
Estonia	-8%	-55%	✓
Hungary	-6%	-46.3%	✓
Latvia	-8%	-57.6%	✓
Lithuania	-8%	-56.2%	✓
Malta	N/A	N/A	✓
Poland	-6%	-29.1%	✓
Romania	-8%	-57.3%	✓
Slovakia	-8%	-40.7%	✓
Slovenia	-8%	-7.1%	X

Base year for all countries is 1990, expect for:

- Bulgaria – 1998
- Hungary – Average of 1985-1987
- Slovenia – 1986
- Poland – 1988
- Romania - 198

Appendix K – The Price of Fuel within the Europe

Table K.1 – The Price of Fuel within the Europe between April and June 2017

#	Country	Price in £	Price in Local Currency
1	Norway	£1.45	15.80 kr
2	Netherlands	£1.34	€1.52
3	Italy	£1.32	€1.50
4	Greece	£1.31	€1.49
5	Denmark	£1.27	10.74 kr.
6	Finland	£1.25	€1.42
	Portugal	£1.25	€1.42
8	Sweden	£1.24	13.62 kr
9	Ireland	£1.18	€1.34
10	Belgium	£1.17	€1.33
	France	£1.17	€1.33
12	Germany	£1.16	€1.32
13	United Kingdom	£1.15	£1.15
14	Slovakia	£1.09	€1.24
15	Croatia	£1.07	€1.22
	Slovenia	£1.07	€1.22
17	Cyprus	£1.04	€1.18
18	Spain	£1.03	€1.17
19	Austria	£1.02	€1.16
20	Czech Republic	£1.00	29.74 Kč
21	Estonia	£0.98	€1.12
	Luxemburg	£0.98	€1.12
23	Hungary	£0.96	337.86 Ft
24	Latvia	£0.95	€1.08
	Lithuania	£0.95	€1.08
26	Poland	£0.91	4.37 zł
27	Bulgaria	£0.89	1.97 leva
28	Romania	£0.87	4.52 lei

Data Adapted from Bloomberg (2017)

Appendix L – Northern Ireland's Greenhouse Gas Emission

Table L.1 – Northern Ireland's Total Greenhouse Gas Emissions (CO^2e) between 1990 and 2018

Year	Total Greenhouse Gas Emissions (CO^2e)			
	Emissions ($MtCO_2e$)	Change	Per cent change	
			Yearly	Overall
1990	24.3			
1995	25.2	+ 0.9		↑ 3.7%
1998	24.7	- 0.5		↑ 1.6%
1999	25.2	+ 0.5	↑ 2.0%	↑ 3.7%
2000	24.9	- 0.3	↓ 1.2%	↑ 2.5%
2001	25.3	+ 0.4	↑ 1.6%	↑ 4.1%
2002	22.9	- 2.4	↓ 9.5%	↓ 5.8%
2003	23.1	+ 0.2	↑ 0.9%	↓ 4.9%
2004	23.0	- 0.1	↓ 0.4%	↓ 5.3%
2005	23.8	+ 0.8	↑ 3.5%	↓ 2.1%
2006	24.2	+ 0.4	↑ 1.7%	↓ 0.4%
2007	23.0	- 1.2	↓ 5.0%	↓ 5.3%
2008	22.6	- 0.4	↓ 1.7%	↓ 7.0%
2009	20.9	- 1.7	↓ 7.5%	↓ 14.0%
2010	21.5	+ 0.6	↑ 2.9%	↓ 11.5%
2011	20.3	- 1.2	↓ 5.6%	↓ 16.5%
2012	20.4	+ 0.1	↑ 0.5%	↓ 16.0%
2013	20.6	+ 0.2	↑ 1.0%	↓ 15.2%
2014	19.8	- 0.8	↓ 3.9%	↓ 18.5%
2015	20.3	+ 0.5	↑ 2.5%	↓ 16.5%
2016	20.6	+ 0.3	↑ 1.5%	↓ 15.2%
2017	19.9	- 0.7	↓ 3.4%	↓ 18.1%
2018	19.4	- 0.5	↓ 2.5%	↓ 20.2%

Source: Data Adapted from DAERA (2020)

Table L.2 – Northern Ireland's total carbon dioxide emissions [$KtCO_2e$] from energy supply and business between 1990 and 2018

Year	Energy Supply				Year	Business			
	Emissions ($KtCO_2e$)	Change	Per cent change			Emissions ($KtCO_2e$)	Change	Per cent change	
			Yearly	Overall				Yearly	Overall
1990	5309.1				**1990**	3039.5			
1995	6531.5	+ 1222.4		↑ 23.0%	**1995**	3056.7	+ 17.2		↑ 0.6%
1998	6187.1	- 344.4		↑ 16.5%	**1998**	2630.6	- 426.1		↓ 13.5%
1999	6282.7	+ 95.6	↑ 1.5%	↑ 18.3%	**1999**	2858.1	+ 227.5	↑ 8.6%	↓ 6.0%
2000	6337.0	+ 54.3	↑ 0.9%	↑ 19.4%	**2000**	2910.1	+ 52.0	↑ 1.8%	↓ 4.3%
2001	6651.1	+ 314.1	↑ 5.0%	↑ 25.3%	**2001**	2968.8	+ 58.7	↑ 2.0%	↓ 2.3%
2002	5219.7	- 1431.4	↓ 21.5%	↓ 1.7%	**2002**	2307.1	- 661.7	↓ 22.3%	↓ 24.1%
2003	5027.6	- 192.1	↓ 3.7%	↓ 5.3%	**2003**	2458.3	+ 151.2	↑ 6.6%	↓ 19.1%
2004	4878.6	- 149.0	↓ 3.0%	↓ 8.1%	**2004**	2495.5	+ 37.2	↑ 1.5%	↓ 17.9%
2005	5340.1	+ 461.5	↑ 9.5%	↑ 0.6%	**2005**	2837.1	+ 341.6	↑ 13.7%	↓ 6.7%
2006	5729.0	+ 388.9	↑ 7.3%	↑ 7.9%	**2006**	2781.3	- 55.8	↓ 2.0%	↓ 8.5%
2007	4651.0	- 1078.0	↓ 18.8%	↓ 12.4%	**2007**	2817.2	+ 35.9	↑ 1.3%	↓ 7.3%
2008	4842.0	+ 191.0	↑ 4.1%	↓ 8.8%	**2008**	2557.3	- 259.9	↓ 9.2%	↓ 15.9%
2009	3688.2	- 1153.8	↓ 23.8%	↓ 30.5%	**2009**	2412.7	- 144.6	↓ 5.7%	↓ 20.6%
2010	3961.7	+ 273.5	↑ 7.4%	↓ 25.4%	**2010**	2667.9	+ 255.2	↑ 10.6%	↓ 12.2%
2011	3747.3	- 214.4	↓ 5.4%	↓ 29.4%	**2011**	2404.2	- 263.7	↓ 9.9%	↓ 20.9%
2012	3876.1	+ 128.8	↑ 3.4%	↓ 27.0%	**2012**	2350.7	- 53.5	↓ 2.2%	↓ 22.7%
2013	4070.4	+ 194.3	↑ 5.0%	↓ 23.3%	**2013**	2356.5	+ 5.8	↑ 0.2%	↓ 22.5%
2014	3835.6	- 234.8	↓ 5.8%	↓ 27.8%	**2014**	2535.4	+ 178.9	↑ 7.6%	↓ 16.6%
2015	3839.3	+ 3.7	↑ 0.1%	↓ 27.7%	**2015**	2614.7	+ 79.3	↑ 3.1%	↓ 14.0%
2016	4027.7	+ 188.4	↑ 4.9%	↓ 24.1%	**2016**	2485.2	- 129.5	↓ 5.0%	↓ 18.2%
2017	3422.4	- 605.3	↓ 15.0%	↓ 35.5%	**2017**	2442.7	- 42.5	↓ 1.7%	↓ 19.6%
2018	2926.8	- 495.6	↓ 14.5%	↓ 44.9%	**2018**	2351.3	- 91.4	↓ 3.7%	↓ 22.6%

Source: Data Adapted from DAERA (2020)

Table L.3 – Northern Ireland's total carbon dioxide emissions [$KtCO_2e$] from transport and public between 1990 and 2018

Year	Transport				Year	Public			
	Emissions ($KtCO_2e$)	Change	Per cent change			Emissions ($KtCO_2e$)	Change	Per cent change	
			Yearly	Overall				Yearly	Overall
1990	3465.3				**1990**	483.5			
1995	3701.2	+ 235.9		↑ 6.8%	**1995**	320.1	- 163.4		↓ 33.8%
1998	3905.0	+ 203.8		↑ 12.7%	**1998**	223.0	- 97.1		↓ 53.9%
1999	4055.1	+ 150.1	↑ 3.8%	↑ 17.0%	**1999**	229.8	+ 6.8	↑ 3.0%	↓ 52.5%
2000	4191.4	+ 136.3	↑ 3.4%	↑ 21.0%	**2000**	186.5	- 43.3	↓ 18.8%	↓ 61.4%
2001	4250.5	+ 59.1	↑ 1.4%	↑ 22.7%	**2001**	189.1	+ 2.6	↑ 1.4%	↓ 60.9%
2002	4419.8	+ 169.3	↑ 4.0%	↑ 27.5%	**2002**	126.7	- 62.4	↓ 33.0%	↓ 73.8%
2003	4582.1	+ 162.3	↑ 3.7%	↑ 32.2%	**2003**	130.6	+ 3.9	↑ 3.1%	↓ 73.0%
2004	4615.9	+ 33.8	↑ 0.7%	↑ 33.2%	**2004**	147.0	+ 16.4	↑ 12.6%	↓ 69.6%
2005	4719.8	+ 103.9	↑ 2.3%	↑ 36.2%	**2005**	181.0	+ 34.0	↑ 23.1%	↓ 62.6%
2006	4737.4	+ 17.6	↑ 0.4%	↑ 36.7%	**2006**	182.7	+ 1.7	↑ 0.9%	↓ 62.2%
2007	4877.4	+ 140.0	↑ 3.0%	↑ 40.7%	**2007**	196.6	+ 13.9	↑ 7.6%	↓ 59.3%
2008	4714.9	- 162.5	↓ 3.3%	↑ 36.1%	**2008**	201.8	+ 5.2	↑ 2.6%	↓ 58.3%
2009	4696.2	- 18.7	↓ 0.4%	↑ 35.5%	**2009**	202.7	+ 0.9	↑ 0.4%	↓ 58.1%
2010	4578.2	- 118.0	↓ 2.5%	↑ 32.1%	**2010**	200.6	- 2.1	↓ 1.0%	↓ 58.5%
2011	4445.9	- 132.3	↓ 2.9%	↑ 28.3%	**2011**	193.9	- 6.7	↓ 3.3%	↓ 59.9%
2012	4416.0	- 29.9	↓ 0.7%	↑ 27.4%	**2012**	193.1	- 0.8	↓ 0.4%	↓ 60.1%
2013	4427.9	+ 11.9	↑ 0.3%	↑ 27.8%	**2013**	199.6	+ 6.5	↑ 3.4%	↓ 58.7%
2014	4333.4	- 94.5	↓ 2.1%	↑ 25.1%	**2014**	182.0	- 17.6	↓ 8.8%	↓ 62.4%
2015	4402.1	+ 68.7	↑ 1.6%	↑ 27.0%	**2015**	181.6	- 0.4	↓ 0.2%	↓ 62.4%
2016	4497.2	+ 95.1	↑ 2.2%	↑ 29.8%	**2016**	136.0	- 45.6	↓ 25.1%	↓ 71.9%
2017	4518.4	+ 21.2	↑ 0.5%	↑ 30.4%	**2017**	142.0	+ 6.0	↑ 4.4%	↓ 70.6%
2018	4453.7	- 64.7	↓ 1.4%	↑ 28.5%	**2018**	151.4	+ 9.4	↑ 6.6%	↓ 68.7%

Source: Data Adapted from DAREA (2020)

Table L.4 – Northern Ireland's total carbon dioxide emissions [$KtCO_2e$] from residential and agriculture between 1990 and 2018

Year	Residential					Year	Agriculture			
	Emissions ($KtCO_2e$)	Change	Per cent change				Emissions ($KtCO_2e$)	Change	Per cent change	
			Yearly	Overall					Yearly	Overall
1990	3676.8					**1990**	5279.5			
1995	2852.3	- 824.5		↓ 22.4%		**1995**	5714.2	+ 434.7		↑ 8.2%
1998	2880.1	+ 27.8		↓ 21.7%		**1998**	5782.8	+ 68.6		↑ 9.5%
1999	2888.7	+ 8.6	↑ 0.3%	↓ 21.4%		**1999**	5715.7	- 67.1	↓ 1.2%	↑ 8.3%
2000	2860.3	- 28.4	↓ 1.0%	↓ 22.2%		**2000**	5474.5	- 241.2	↓ 4.2%	↑ 3.7%
2001	2819.2	- 41.1	↓ 1.4%	↓ 23.3%		**2001**	5450.9	- 23.6	↓ 0.4%	↑ 3.2%
2002	2899.0	+ 79.8	↑ 2.8%	↓ 21.2%		**2002**	5416.3	- 34.6	↓ 0.6%	↑ 2.6%
2003	2934.5	+ 35.5	↑ 1.2%	↓ 20.2%		**2003**	5476.0	+ 59.7	↑ 1.1%	↑ 3.7%
2004	2918.8	- 15.7	↓ 0.5%	↓ 20.6%		**2004**	5411.9	- 64.1	↓ 1.2%	↑ 2.5%
2005	2602.9	- 315.9	↓ 10.8%	↓ 29.2%		**2005**	5406.0	- 5.9	↓ 0.1%	↑ 2.4%
2006	2777.1	+ 174.2	↑ 6.7%	↓ 24.5%		**2006**	5266.8	- 139.2	↓ 2.6%	↓ 0.2%
2007	2586.7	- 190.4	↓ 6.9%	↓ 29.6%		**2007**	5147.0	- 119.8	↓ 2.3%	↓ 2.5%
2008	2750.0	+ 163.3	↑ 6.3%	↓ 25.2%		**2008**	5018.6	- 128.4	↓ 2.5%	↓ 4.9%
2009	2776.4	+ 26.4	↑ 1.0%	↓ 24.5%		**2009**	4988.8	- 29.8	↓ 0.6%	↓ 5.5%
2010	3161.7	+ 385.3	↑ 13.9%	↓ 14.0%		**2010**	5066.7	+ 77.9	↑ 1.6%	↓ 4.0%
2011	2573.1	- 588.6	↓ 18.6%	↓ 30.0%		**2011**	5092.0	+ 25.3	↑ 0.5%	↓ 3.6%
2012	2622.7	+ 49.6	↑ 1.9%	↓ 28.7%		**2012**	5108.9	+ 16.9	↑ 0.3%	↓ 3.2%
2013	2829.1	+ 206.4	↑ 7.9%	↓ 23.1%		**2013**	5118.8	+ 9.9	↑ 0.2%	↓ 3.0%
2014	2488.4	- 340.7	↓ 12.0%	↓ 32.3%		**2014**	5135.0	+ 16.2	↑ 0.3%	↓ 2.7%
2015	2574.0	+ 85.6	↑ 3.4%	↓ 30.0%		**2015**	5212.3	+ 77.3	↑ 1.5%	↓ 1.3%
2016	2725.0	+ 151.0	↑ 5.9%	↓ 25.9%		**2016**	5347.3	+ 135.0	↑ 2.6%	↑ 1.3%
2017	2613.5	- 111.5	↓ 4.1%	↓ 28.9%		**2017**	5415.1	+ 67.8	↑ 1.3%	↑ 2.6%
2018	2748.7	+ 135.2	↑ 5.2%	↓ 25.2%		**2018**	5323.3	- 91.8	↓ 1.7%	↑ 0.8%

Source: Data Adapted from DAREA (2020)

Table L.5 – Northern Ireland's total carbon dioxide emissions [$KtCO_2e$] from industrial processes and waste management between 1990 and 2018

Year	Industrial Processes					Year	Waste Management			
	Emissions ($KtCO_2e$)	Change	Per cent change				Emissions ($KtCO_2e$)	Change	Per cent change	
			Yearly	Overall					Yearly	Overall
1990	759.8					**1990**	1860.1			
1995	764.8	+ 5.0		↑ 0.7%		**1995**	2037.3	+ 177.2		↑ 9.5%
1998	816.1	+ 51.3		↑ 7.4%		**1998**	2115.2	+ 77.9		↑ 13.7%
1999	923.7	+ 107.6	↑ 13.2%	↑ 21.6%		**1999**	2112.7	- 2.5	↓ 0.1%	↑ 13.6%
2000	668.0	- 255.7	↓ 27.7%	↓ 12.1%		**2000**	2117.8	+ 5.1	↑ 0.2%	↑ 13.9%
2001	634.9	- 33.1	↓ 5.0%	↓ 16.4%		**2001**	2101.9	- 15.9	↓ 0.8%	↑ 13.0%
2002	213.0	- 421.9	↓ 66.5%	↓ 72.0%		**2002**	2089.1	- 12.8	↓ 0.6%	↑ 12.3%
2003	220.3	+ 7.3	↑ 3.4%	↓ 71.0%		**2003**	2059.0	- 30.1	↓ 1.4%	↑ 10.7%
2004	224.5	+ 4.2	↑ 1.9%	↓ 70.5%		**2004**	2041.7	- 17.3	↓ 0.8%	↑ 9.8%
2005	422.3	+ 197.8	↑ 88.1%	↓ 44.4%		**2005**	2000.9	- 40.8	↓ 2.0%	↑ 7.6%
2006	434.4	+ 12.1	↑ 2.9%	↓ 42.8%		**2006**	1958.3	- 42.6	↓ 2.1%	↑ 5.3%
2007	490.7	+ 56.3	↑ 13.0%	↓ 35.4%		**2007**	1922.6	- 35.7	↓ 1.8%	↑ 3.4%
2008	403.4	- 87.3	↓ 17.8%	↓ 46.9%		**2008**	1813.1	- 109.5	↓ 5.7%	↓ 2.5%
2009	180.5	- 222.9	↓ 55.3%	↓ 76.2%		**2009**	1601.2	- 211.9	↓ 11.7%	↓ 13.9%
2010	172.9	- 7.6	↓ 4.2%	↓ 77.2%		**2010**	1310.8	- 290.4	↓ 18.1%	↓ 29.5%
2011	164.8	- 8.1	↓ 4.7%	↓ 78.3%		**2011**	1250.5	- 60.3	↓ 4.6%	↓ 32.8%
2012	163.9	- 0.9	↓ 0.5%	↓ 78.4%		**2012**	1170.8	- 79.7	↓ 6.4%	↓ 37.1%
2013	150.4	- 13.5	↓ 8.2%	↓ 80.2%		**2013**	1062.8	- 108.0	↓ 9.2%	↓ 42.9%
2014	182.8	+ 32.4	↑ 21.5%	↓ 75.9%		**2014**	727.2	- 335.6	↓ 31.6%	↓ 60.9%
2015	230.8	+ 48.0	↑ 26.3%	↓ 69.6%		**2015**	828.5	+ 101.3	↑ 13.9%	↓ 55.5%
2016	170.2	- 60.6	↓ 26.3%	↓ 77.6%		**2016**	794.3	- 34.2	↓ 4.1%	↓ 57.3%
2017	165.0	- 5.2	↓ 3.1%	↓ 78.3%		**2017**	714.6	- 79.7	↓ 10.0%	↓ 61.6%
2018	174.3	+ 9.3	↑ 5.6%	↓ 77.1%		**2018**	784.1	+ 69.5	↑ 9.7%	↓ 57.8%

Source: Data Adapted from DAREA (2020)

Table L.6 – Northern Ireland's total carbon dioxide emissions [$KtCO_2e$] from LULUCF between 1990 and 2018

Year	*LULUCF*			
	Emissions ($KtCO_2e$)	Change	Per cent change	
			Yearly	Overall
1990	388.6			
1995	228.6	- 160.0		↓ 41.2%
1998	158.7	- 69.9		↓ 59.2%
1999	140.5	- 18.2	↓ 11.5%	↓ 63.8%
2000	161.5	+ 21.0	↑ 14.9%	↓ 58.4%
2001	200.1	+ 38.6	↑ 23.9%	↓ 48.5%
2002	217.3	+ 17.2	↑ 8.6%	↓ 44.1%
2003	237.5	+ 20.2	↑ 9.3%	↓ 38.9%
2004	273.4	+ 35.9	↑ 15.1%	↓ 29.6%
2005	287.4	+ 14.0	↑ 5.1%	↓ 26.0%
2006	292.1	+ 4.7	↑ 1.6%	↓ 24.8%
2007	319.7	+ 27.6	↑ 9.4%	↓ 17.7%
2008	333.9	+ 14.2	↑ 4.4%	↓ 14.1%
2009	354.3	+ 20.4	↑ 6.1%	↓ 8.8%
2010	362.9	+ 8.6	↑ 2.4%	↓ 6.6%
2011	389.0	+ 26.1	↑ 7.2%	↑ 0.1%
2012	544.1	+ 155.1	↑ 39.9%	↑ 40.0%
2013	410.1	- 134.0	↓ 24.6%	↑ 5.5%
2014	423.4	+ 13.3	↑ 3.2%	↑ 9.0%
2015	438.4	+ 15.0	↑ 3.5%	↑ 12.8%
2016	444.3	+ 5.9	↑ 1.3%	↑ 14.3%
2017	487.5	+ 43.2	↑ 9.7%	↑ 25.5%
2018	514.8	+ 27.3	↑ 5.6%	↑ 32.5%

Source: Data Adapted from DAREA (2020)

Appendix M – Scotland's Greenhouse Gas Emissions

Table M.1 – Scotland's Total Greenhouse Gas Emissions (CO^2e) and CO^2 emissions between 1990 and 2018

Year	CO^2 Emissions					Year	Total Greenhouse Gas Emissions (CO^2e)			
	Emissions ($MtCO_2e$)	Change	Per cent change				Emissions ($MtCO_2e$)	Change	Per cent change	
			Yearly	Overall					Yearly	Overall
1990	58.2					**1990**	76.2			
1995	59.1	+ 0.9		↑ 1.5%		**1995**	76.8	+ 0.6		↑ 0.8%
1998	58.0	- 1.1		↓ 0.3%		**1998**	75.6	- 1.2		↓ 0.8%
1999	55.7	- 2.3	↓ 4.0%	↓ 4.3%		**1999**	72.6	- 3.0	↓ 4.0%	↓ 4.7%
2000	57.3	+ 1.6	↑ 2.9%	↓ 1.5%		**2000**	73.9	+ 1.3	↑ 1.8%	↓ 3.0%
2001	56.8	- 0.5	↓ 0.9%	↓ 2.4%		**2001**	73.0	- 0.9	↓ 1.2%	↓ 4.2%
2002	53.2	- 3.6	↓ 6.3%	↓ 8.6%		**2002**	68.8	- 4.2	↓ 5.8%	↓ 9.7%
2003	53.5	+ 0.3	↑ 0.6%	↓ 8.1%		**2003**	68.9	+ 0.1	↑ 0.1%	↓ 9.6%
2004	51.6	- 1.9	↓ 3.6%	↓ 11.3%		**2004**	66.4	- 2.5	↓ 3.6%	↓ 12.9%
2005	50.0	- 1.6	↓ 3.1%	↓ 14.1%		**2005**	64.4	- 2.0	↓ 3.0%	↓ 15.5%
2006	52.9	+ 2.9	↑ 5.8%	↓ 9.1%		**2006**	66.6	+ 2.2	↑ 3.4%	↓ 12.6%
2007	49.1	- 3.8	↓ 7.2%	↓ 15.6%		**2007**	62.4	- 4.2	↓ 6.3%	↓ 18.1%
2008	47.5	- 1.6	↓ 3.3%	↓ 18.4%		**2008**	60.3	- 2.1	↓ 3.4%	↓ 20.9%
2009	43.7	- 3.8	↓ 8.0%	↓ 24.9%		**2009**	56.3	- 4.0	↓ 6.6%	↓ 26.1%
2010	46.5	+ 2.8	↑ 6.4%	↓ 20.1%		**2010**	58.9	+ 2.6	↑ 4.6%	↓ 22.7%
2011	40.1	- 6.4	↓ 13.8%	↓ 31.1%		**2011**	52.1	- 6.8	↓ 11.5%	↓ 31.6%
2012	40.8	+ 0.7	↑ 1.7%	↓ 29.9%		**2012**	52.5	+ 0.4	↑ 0.8%	↓ 31.1%
2013	39.8	- 1.0	↓ 2.5%	↓ 31.6%		**2013**	50.8	- 1.7	↓ 3.2%	↓ 33.3%
2014	36.2	- 3.6	↓ 9.0%	↓ 37.8%		**2014**	47.3	- 3.5	↓ 6.9%	↓ 37.9%
2015	34.9	- 1.3	↓ 3.6%	↓ 40.0%		**2015**	46.2	- 1.1	↓ 2.3%	↓ 39.4%
2016	31.0	- 3.9	↓ 11.2%	↓ 46.7%		**2016**	42.0	- 4.2	↓ 9.1%	↓ 44.9%
2017	30.0	- 1.0	↓ 3.2%	↓ 48.5%		**2017**	41.0	- 1.0	↓ 2.4%	↓ 46.2%
2018	30.9	+ 0.9	↑ 3.0%	↓ 46.9%		**2018**	41.6	+ 0.6	↑ 1.5%	↓ 45.4%

Source: Data Adapted from Scottish Government (2020)

Table M.2 – Scotland's total carbon dioxide emissions [KtCO_2e] from energy supply and business between 1990 and 2018

Year	Energy Supply					Year	Business			
	Emissions (KtCO_2e)	Change	Per cent change				Emissions (KtCO_2e)	Change	Per cent change	
			Yearly	Overall					Yearly	Overall
1990	22,728.5					**1990**	12,414.6			
1995	26,749.4	+ 4,020.9		↑ 17.7%		**1995**	10,491.4	- 1923.2		↓ 15.5%
1998	25,786.8	- 962.5		↑ 13.5%		**1998**	10,403.5	- 87.9		↓ 16.2%
1999	23,359.9	- 2,426.9	↓ 9.4%	↑ 2.8%		**1999**	10,650.2	+ 246.6	↑ 2.4%	↓ 14.2%
2000	26,308.4	+ 2,948.5	↑ 12.6%	↑ 15.8%		**2000**	10,597.9	- 52.2	↓ 0.5%	↓ 14.6%
2001	25,636.1	- 672.3	↓ 2.6%	↑ 12.8%		**2001**	10,940.4	+ 342.4	↑ 3.2%	↓ 11.9%
2002	23,557.1	- 2,078.9	↓ 8.1%	↑ 3.6%		**2002**	10,098.8	- 841.6	↓ 7.7%	↓ 18.7%
2003	23,727.4	+ 170.2	↑ 0.7%	↑ 4.4%		**2003**	10,364.4	+ 265.6	↑ 2.6%	↓ 16.5%
2004	21,938.9	- 1,788.4	↓ 7.5%	↓ 3.5%		**2004**	10,282.0	- 82.4	↓ 0.8%	↓ 17.2%
2005	20,792.7	- 1,146.3	↓ 5.2%	↓ 8.5%		**2005**	10,157.2	- 124.8	↓ 1.2%	↓ 18.2%
2006	24,643.9	+ 3,851.3	↑ 18.5%	↑ 8.4%		**2006**	9,821.3	- 335.9	↓ 3.3%	↓ 20.9%
2007	21,400.8	- 3,243.2	↓ 13.2%	↓ 5.8%		**2007**	9,346.1	- 475.2	↓ 4.8%	↓ 24.7%
2008	20,085.9	- 1,314.9	↓ 6.1%	↓ 11.6%		**2008**	9,808.7	+ 462.6	↑ 4.9%	↓ 21.0%
2009	18,692.0	- 1,393.9	↓ 6.9%	↓ 17.8%		**2009**	8,769.0	- 1039.6	↓ 10.6%	↓ 29.4%
2010	20,897.6	+ 2,205.5	↑ 11.8%	↓ 8.1%		**2010**	9,010.5	+ 241.4	↑ 2.8%	↓ 27.4%
2011	17,029.8	- 3,867.8	↓ 18.5%	↓ 25.1%		**2011**	8,712.5	- 297.9	↓ 3.3%	↓ 29.8%
2012	17,425.3	+ 395.5	↑ 2.3%	↓ 23.3%		**2012**	8,628.4	- 84.2	↓ 1.0%	↓ 30.5%
2013	15,979.1	- 1,446.1	↓ 8.3%	↓ 29.7%		**2013**	8,729.2	+ 100.9	↑ 1.2%	↓ 29.7%
2014	13,882.5	- 2,096.6	↓ 13.1%	↓ 38.9%		**2014**	8,179.6	- 549.6	↓ 6.3%	↓ 34.1%
2015	12,249.8	- 1,632.7	↓ 11.8%	↓ 46.1%		**2015**	8,216.6	+ 37.0	↑ 0.5%	↓ 33.8%
2016	7,437.8	- 4,811.9	↓ 39.3%	↓ 67.3%		**2016**	8,248.8	+ 32.2	↑ 0.4%	↓ 33.6%
2017	6,001.0	- 1,436.8	↓ 19.3%	↓ 73.6%		**2017**	8,505.9	+ 257.1	↑ 3.1%	↓ 31.5%
2018	6,803.8	+ 802.8	↑ 13.4%	↓ 70.0%		**2018**	8,413.2	- 92.7	↓ 1.1%	↓ 32.2%

Source: Data Adapted from Scottish Government (2020)

Table M.3 – Scotland's total carbon dioxide emissions [KtCO₂e] from transport and public between 1990 and 2018

Year	Transport[65]				Year	Public			
	Emissions ($KtCO_2e$)	Change	Per cent change			Emissions ($KtCO_2e$)	Change	Per cent change	
			Yearly	Overall				Yearly	Overall
1990	13,566.6				**1990**	1,686.4			
1995	14,352.2	+ 785.6		↑ 5.8%	**1995**	1,806.1	+ 119.7		↑ 7.1%
1998	14,760.8	+ 408.6		↑ 8.8%	**1998**	1,769.0	- 37.1		↑ 4.9%
1999	14,860.4	+ 99.6	↑ 0.7%	↑ 9.5%	**1999**	1,757.4	- 11.6	↓ 0.7%	↑ 4.2%
2000	14,314.1	- 546.3	↓ 3.7%	↑ 5.5%	**2000**	1,645.0	- 112.4	↓ 6.4%	↓ 2.5%
2001	14,014.4	- 299.7	↓ 2.1%	↑ 3.3%	**2001**	1,683.3	+ 38.4	↑ 2.3%	↓ 0.2%
2002	14,528.5	+ 514.1	↑ 3.7%	↑ 7.1%	**2002**	1,432.6	- 250.7	↓ 14.9%	↓ 15.0%
2003	14,357.5	- 171.0	↓ 1.2%	↑ 5.8%	**2003**	1,427.7	- 4.9	↓ 0.3%	↓ 15.3%
2004	14,266.1	- 91.4	↓ 0.6%	↑ 5.2%	**2004**	1,552.7	+125.0	↑ 8.8%	↓ 7.9%
2005	14,350.2	+ 84.1	↑ 0.6%	↑ 5.8%	**2005**	1,526.7	- 26.0	↓ 1.7%	↓ 9.5%
2006	14,234.7	- 115.5	↓ 0.8%	↑ 4.9%	**2006**	1,378.9	- 147.8	↓ 9.7%	↓ 18.2%
2007	14,502.7	+ 268.1	↑ 1.9%	↑ 6.9%	**2007**	1,279.8	- 99.0	↓ 7.2%	↓ 24.1%
2008	13,856.9	- 645.9	↓ 4.5%	↑ 2.1%	**2008**	1,332.1	+ 52.3	↑ 4.1%	↓ 21.0%
2009	13,307.6	- 549.3	↓ 4.0%	↓ 1.9%	**2009**	1,196.2	- 136.0	↓ 10.2%	↓ 29.1%
2010	12,989.5	- 318.1	↓ 2.4%	↓ 4.3%	**2010**	1,277.9	+ 81.7	↑ 6.8%	↓ 24.2%
2011	12,436.3	- 553.2	↓ 4.3%	↓ 8.3%	**2011**	1,056.9	- 221.0	↓ 17.3%	↓ 37.3%
2012	12,264.5	- 171.8	↓ 1.4%	↓ 9.6%	**2012**	1,194.0	+ 137.1	↑ 13.0%	↓ 29.2%
2013	12,095.1	- 169.5	↓ 1.4%	↓ 10.8%	**2013**	1,199.0	+ 5.0	↑ 0.4%	↓ 28.9%
2014	12,185.9	+ 90.8	↑ 0.8%	↓ 10.2%	**2014**	1,023.0	- 176.0	↓ 14.7%	↓ 39.3%
2015	12,433.5	+ 247.7	↑ 2.0%	↓ 8.4%	**2015**	1,093.3	+ 70.3	↑ 6.9%	↓ 35.2%
2016	12,754.2	+ 320.7	↑ 2.6%	↓ 6.0%	**2016**	1,113.0	+ 19.7	↑ 1.8%	↓ 34.0%
2017	13,042.5	+ 288.3	↑ 1.3%	↓ 3.9%	**2017**	1,047.0	- 66.0	↓ 5.9%	↓ 37.9%
2018	12,905.2	- 137.3	↓ 1.1%	↓ 4.9%	**2018**	1,099.0	+ 52.0	↑ 5.0%	↓ 34.8%

Source: Data Adapted from Scottish Government (2020)

[65] - Excluding International

Table M.4 – Scotland's total carbon dioxide emissions [$KtCO_2e$] from residential and agriculture between 1990 and 2018

Year	Residential					Year	Agriculture			
	Emissions ($KtCO_2e$)	Change	Per cent change				Emissions ($KtCO_2e$)	Change	Per cent change	
			Yearly	Overall					Yearly	Overall
1990	8,005.0					**1990**	8,889.2			
1995	7,844.7	- 160.3		↓ 2.8%		**1995**	8,902.9	+ 13.8		↑ 0.2%
1998	8,068.2	+ 223.5		↑ 0.8%		**1998**	8,883.8	- 19.1		↓ 0.1%
1999	7,957.9	- 110.3	↓ 1.4%	↓ 0.6%		**1999**	8,868.4	- 15.4	↓ 0.2%	↓ 0.2%
2000	7,818.5	- 139.4	↓ 1.8%	↓ 2.3%		**2000**	8,574.8	- 293.6	↓ 3.3%	↓ 3.5%
2001	8,316.0	+ 497.5	↑ 6.4%	↑ 3.9%		**2001**	8,305.0	- 269.9	↓ 3.1%	↓ 6.6%
2002	7,612.1	- 703.9	↓ 8.5%	↓ 4.9%		**2002**	8,319.0	+ 14.1	↑ 0.2%	↓ 6.4%
2003	7,606.5	- 5.6	↓ 0.1%	↓ 5.0%		**2003**	8,390.8	+ 71.8	↑ 0.9%	↓ 5.6%
2004	7,764.4	+ 157.9	↑ 2.1%	↓ 3.0%		**2004**	8,331.3	- 59.5	↓ 0.7%	↓ 6.3%
2005	7,708.4	- 56.1	↓ 0.7%	↓ 3.7%		**2005**	8,227.7	- 103.6	↓ 1.2%	↓ 7.4%
2006	7,504.0	- 204.4	↓ 2.7%	↓ 6.3%		**2006**	8,024.9	- 202.8	↓ 2.5%	↓ 9.7%
2007	7,268.9	- 235.0	↓ 3.1%	↓ 9.2%		**2007**	8,170.9	+ 145.9	↑ 1.8%	↓ 8.1%
2008	7,473.8	+ 204.9	↑ 2.8%	↓ 6.6%		**2008**	7,721.9	- 449.0	↓ 5.5%	↓ 13.1%
2009	7,183.5	- 290.3	↓ 3.9%	↓ 10.3%		**2009**	7,703.2	- 18.7	↓ 0.2%	↓ 13.3%
2010	8,016.0	+ 832.5	↑ 11.6%	↑ 0.1%		**2010**	7,748.6	+ 45.4	↑ 0.6%	↓ 12.8%
2011	6,489.4	- 1,526.6	↓ 19.0%	↓ 18.9%		**2011**	7,721.6	- 27.0	↓ 0.3%	↓ 13.1%
2012	7,030.3	+ 540.8	↑ 8.3%	↓ 12.2%		**2012**	7,679.5	- 42.1	↓ 0.5%	↓ 13.6%
2013	7,069.9	+ 39.6	↑ 0.6%	↓ 11.7%		**2013**	7,600.1	- 79.4	↓ 1.0%	↓ 14.5%
2014	5,914.1	- 1,155.8	↓ 16.3%	↓ 26.1%		**2014**	7,744.3	+ 144.2	↑ 1.9%	↓ 12.9%
2015	6,107.4	+ 193.4	↑ 3.3%	↓ 23.7%		**2015**	7,617.1	- 127.2	↓ 1.6%	↓ 14.3%
2016	6,215.3	+ 107.8	↑ 1.8%	↓ 22.4%		**2016**	7,634.9	+ 17.8	↑ 0.2%	↓ 14.1%
2017	6,024.7	- 190.5	↓ 3.1%	↓ 24.7%		**2017**	7,603.6	- 31.4	↓ 0.4%	↓ 14.5%
2018	6,231.3	+ 206.5	↑ 3.4%	↓ 22.2%		**2018**	7,473.5	- 130.0	↓ 1.3%	↓ 15.9%

Source: Data Adapted from Scottish Government (2020)

Table M.5 – Scotland's total carbon dioxide emissions [$KtCO_2e$] from industrial processes and waste management between 1990 and 2018

Year	Industrial Processes				Year	Waste Management			
	Emissions ($KtCO_2e$)	Change	Per cent change			Emissions ($KtCO_2e$)	Change	Per cent change	
			Yearly	Overall				Yearly	Overall
1990	1,923.6				**1990**	6,027.2			
1995	580.2	- 1,343.4		↓ 69.8%	**1995**	6,248.5	+ 221.2		↑ 3.7%
1998	646.0	+ 65.8		↓ 66.4%	**1998**	6,092.4	- 156.1		↑ 1.1%
1999	615.6	- 30.4	↓ 4.7%	↓ 68.0%	**1999**	5,860.4	- 232.0	↓ 3.8%	↓ 2.8%
2000	598.0	- 17.6	↓ 2.9%	↓ 68.9%	**2000**	5,737.4	- 123.0	↓ 2.1%	↓ 4.8%
2001	576.8	- 21.2	↓ 3.5%	↓ 70.0%	**2001**	5,397.9	- 339.5	↓ 5.9%	↓ 10.4%
2002	612.1	+ 35.3	↑ 6.1%	↓ 68.2%	**2002**	5,210.4	- 187.5	↓ 3.5%	↓ 13.6%
2003	628.1	+ 16.1	↑ 2.6%	↓ 67.3%	**2003**	5,080.2	- 130.2	↓ 2.5%	↓ 15.7%
2004	634.7	+ 6.5	↑ 1.0%	↓ 67.0%	**2004**	4,450.5	- 629.7	↓ 12.4%	↓ 26.2%
2005	546.9	- 87.7	↓ 13.8%	↓ 71.6%	**2005**	4,040.9	- 409.6	↓ 9.2%	↓ 33.0%
2006	558.4	+ 11.5	↑ 2.1%	↓ 71.0%	**2006**	3,619.9	- 421.0	↓ 10.4%	↓ 39.9%
2007	539.7	- 18.7	↓ 3.4%	↓ 71.9%	**2007**	3,241.5	- 378.4	↓ 10.5%	↓ 46.2%
2008	529.2	- 10.5	↓ 1.9%	↓ 72.5%	**2008**	3,090.8	- 150.7	↓ 4.6%	↓ 48.7%
2009	405.9	- 123.2	↓ 23.3%	↓ 78.9%	**2009**	2,768.4	- 322.4	↓ 10.4%	↓ 54.1%
2010	391.9	- 14.0	↓ 3.4%	↓ 79.6%	**2010**	2,529.1	- 239.3	↓ 8.6%	↓ 58.0%
2011	451.7	+ 59.7	↑ 15.2%	↓ 76.5%	**2011**	2,393.0	- 136.1	↓ 5.4%	↓ 60.3%
2012	449.3	- 2.4	↓ 0.5%	↓ 76.6%	**2012**	2,048.0	- 345.0	↓ 14.4%	↓ 66.0%
2013	499.4	+ 50.1	↑ 11.2%	↓ 74.0%	**2013**	1,452.1	- 596.0	↓ 29.1%	↓ 75.9%
2014	541.8	+ 42.4	↑ 8.5%	↓ 71.8%	**2014**	1,477.3	+ 25.3	↑ 1.7%	↓ 75.5%
2015	430.6	- 111.2	↓ 20.5%	↓ 77.6%	**2015**	1,729.3	+ 252.0	↑ 17.1%	↓ 71.3%
2016	522.4	+ 91.8	↑ 21.3%	↓ 72.8%	**2016**	1,646.3	- 83.0	↓ 4.8%	↓ 72.7%
2017	553.3	+ 30.9	↑ 5.9%	↓ 71.2%	**2017**	1,704.3	+ 58.0	↑ 3.5%	↓ 71.7%
2018	536.2	- 17.0	↓ 3.1%	↓ 72.1%	**2018**	1,675.8	- 28.5	↓ 1.7%	↓ 72.2%

Source: Data Adapted from Scottish Government (2020)

Table M.6 – Scotland's total carbon dioxide emissions [$KtCO_2e$] from international aviation and shipping and LULUCF between 1990 and 2018

Year	International Aviation and Shipping				Year	LULUCF			
	Emissions ($KtCO_2e$)	Change	Per cent change			Emissions ($KtCO_2e$)	Change	Per cent change	
			Yearly	Overall				Yearly	Overall
1990	1,312.6				**1990**	- 353.5			
1995	1,460.7	+ 148.1		↑ 11.3%	**1995**	- 1,603.2	- 1249.6		↑ 353.5%
1998	1,747.6	+ 286.9		↑ 33.1%	**1998**	- 2,512.7	- 909.5		↑ 610.8%
1999	1,579.8	- 167.7	↓ 9.6%	↑ 20.4%	**1999**	- 2,866.9	- 354.2	↑ 14.1%	↑ 710.9%
2000	1,425.0	- 154.9	↓ 9.8%	↑ 8.6%	**2000**	- 3,076.9	- 210.1	↑ 7.3%	↑ 770.4%
2001	1,548.6	+ 123.7	↑ 8.7%	↑ 18.0%	**2001**	- 3,456.5	- 379.6	↑ 12.2%	↑ 877.7%
2002	1,388.7	- 159.9	↓ 10.3%	↑ 5.8%	**2002**	- 3,928.2	- 471.7	↑ 13.6%	↑ 1,011.2%
2003	1,327.7	- 61.0	↓ 4.4%	↑ 1.1%	**2003**	- 3,995.1	- 66.9	↑ 1.7%	↑ 1,030.1%
2004	1,503.5	+ 175.8	↑ 13.2%	↑ 14.5%	**2004**	- 4,352.5	- 357.4	↑ 8.9%	↑ 1,131.2%
2005	1,612.3	+ 108.8	↑ 7.2%	↑ 22.8%	**2005**	- 4,584.8	- 232.3	↑ 5.3%	↑ 1,196.9%
2006	1,697.2	+ 84.9	↑ 5.3%	↑ 29.3%	**2006**	- 4,925.6	- 340.8	↑ 7.4%	↑ 1,293.3%
2007	1,746.7	+ 49.5	↑ 2.9%	↑ 33.1%	**2007**	- 5,096.1	- 170.5	↑ 3.5%	↑ 1,341.5%
2008	1,779.8	+ 33.1	↑ 1.9%	↑ 35.6%	**2008**	- 5,372.9	- 276.8	↑ 5.4%	↑ 1,419.8%
2009	1,632.1	- 147.8	↓ 8.3%	↑ 24.3%	**2009**	- 5,379.5	- 6.6	↑ 0.1%	↑ 1,421.7%
2010	1,433.0	- 199.1	↓ 12.2%	↑ 9.2%	**2010**	- 5,438.3	- 58.7	↑ 1.1%	↑ 1,438.3%
2011	1,555.0	+ 122.0	↑ 8.5%	↑ 18.5%	**2011**	- 5,732.0	- 293.7	↑ 5.4%	↑ 1,521.4%
2012	1,463.2	- 91.8	↓ 5.9%	↑ 11.5%	**2012**	- 5,660.2	+ 71.8	↓ 1.3%	↑ 1,501.1%
2013	1,539.4	+ 76.2	↑ 5.2%	↑ 17.3%	**2013**	- 5,412.7	+ 247.5	↓ 4.4%	↑ 1,431.1%
2014	1,638.4	+ 99.0	↑ 6.4%	↑ 24.8%	**2014**	- 5,286.9	+ 125.9	↓ 2.3%	↑ 1,395.5%
2015	1,703.3	+ 64.9	↑ 4.0%	↑ 29.8%	**2015**	- 5,388.6	- 101.7	↑ 1.9%	↑ 1,424.3%
2016	1,814.0	+ 110.7	↑ 6.5%	↑ 38.2%	**2016**	- 5,350.2	+ 38.4	↓ 0.7%	↑ 1,413.4%
2017	1,926.4	+ 112.4	↑ 6.2%	↑ 46.8%	**2017**	- 5,419.6	- 69.5	↑ 1.3%	↑ 1,433.1%
2018	1,901.8	- 24.6	↓ 1.3%	↑ 44.9%	**2018**	- 5,426.8	- 7.2	↑ 0.1%	↑ 1,435.1%

Source: Data Adapted from Scottish Government (2020)

Appendix N – Wales's Greenhouse Gas Emissions

Table N.1 – Wales's Total Greenhouse Gas Emissions (MtCO²e) between 1990 and 2018

Year	Total Greenhouse Gas Emissions (CO²e)			
	Emissions (MtCO₂e)	Change	Per cent change	
			Yearly	Overall
1990	56.4			
1995	52.5	- 3.9		↓ 6.9%
1998	54.2	+ 1.7		↓ 4.0%
1999	56.1	+ 1.9	↑ 3.6%	↓ 0.5%
2000	58.1	+ 2.0	↑ 3.5%	↑ 2.9%
2001	54.8	- 3.3	↓ 5.6%	↓ 2.8%
2002	47.9	- 6.9	↓ 12.6%	↓ 15.0%
2003	49.1	+ 1.1	↑ 2.4%	↓ 13.0%
2004	52.9	+ 3.8	↑ 7.8%	↓ 6.2%
2005	51.0	- 1.9	↓ 3.7%	↓ 9.7%
2006	52.1	+ 1.2	↑ 2.3%	↓ 7.6%
2007	49.3	- 2.8	↓ 5.4%	↓ 12.6%
2008	50.7	+ 1.3	↑ 2.7%	↓ 10.2%
2009	44.3	- 6.3	↓ 12.5%	↓ 21.5%
2010	47.5	+ 3.2	↑ 7.1%	↓ 15.9%
2011	44.3	- 3.1	↓ 6.6%	↓ 21.4%
2012	46.1	+ 1.8	↑ 4.0%	↓ 18.3%
2013	51.1	+ 5.0	↑ 10.8%	↓ 9.4%
2014	46.9	- 4.2	↓ 8.3%	↓ 16.9%
2015	46.5	- 0.3	↓ 0.7%	↓ 17.5%
2016	48.8	+ 2.3	↑ 4.9%	↓ 13.5%
2017	42.4	- 6.4	↓ 13.1%	↓ 24.9%
2018	38.9	- 3.5	↓ 8.3%	↓ 31.1%

Source: Data Adapted from StatsWales (2020)

Table N.2 – Wales's total carbon dioxide emissions [$KtCO_2e$] from energy supply and business between 1990 and 2018

Year	Energy Supply				Year	Business			
	Emissions ($KtCO_2e$)	Change	Per cent change			Emissions ($KtCO_2e$)	Change	Per cent change	
			Yearly	Overall				Yearly	Overall
1990	18,015.2				**1990**	13,487.4			
1995	13,087.9	- 4,927.4		↓ 27.4%	**1995**	14,266.2	+ 778.8		↑ 5.8%
1998	13,918.6	+ 830.8		↓ 22.7%	**1998**	14,755.8	+ 489.6		↑ 9.4%
1999	13,600.2	- 318.5	↓ 2.3%	↓ 24.5%	**1999**	16,644.4	+ 1,888.6	↑ 12.8%	↑ 23.4%
2000	16,433.8	+ 2,833.6	↑ 20.8%	↓ 8.8%	**2000**	16,538.4	- 106.1	↓ 0.6%	↑ 22.6%
2001	17,434.8	+ 1,001.0	↑ 6.1%	↓ 3.2%	**2001**	13,212.9	- 3,325.4	↓ 20.1%	↓ 2.0%
2002	15,825.5	- 1,609.3	↓ 9.2%	↓ 12.2%	**2002**	9,204.4	- 4,008.6	↓ 30.3%	↓ 31.8%
2003	15,187.1	- 638.4	↓ 4.0%	↓ 15.7%	**2003**	10,459.8	+ 1,255.5	↑ 13.6%	↓ 22.4%
2004	17,892.8	+ 2,705.7	↑ 17.8%	↓ 0.7%	**2004**	11,155.0	+ 695.2	↑ 6.6%	↓ 17.3%
2005	17,636.6	- 256.3	↓ 1.4%	↓ 2.1%	**2005**	10,091.2	- 1,063.8	↓ 9.5%	↓ 25.2%
2006	18,840.5	+ 1,204.0	↑ 6.8%	↑ 4.6%	**2006**	10,536.9	+ 445.6	↑ 4.4%	↓ 21.9%
2007	16,594.2	- 2,246.4	↓ 11.9%	↓ 7.9%	**2007**	10,521.2	- 15.6	↓ 0.1%	↓ 22.0%
2008	19,446.1	+ 2,851.9	↑ 17.2%	↑ 7.9%	**2008**	9,859.9	- 661.3	↓ 6.3%	↓ 26.9%
2009	16,513.8	- 2,932.3	↓ 15.1%	↓ 8.3%	**2009**	8,202.3	- 1,657.7	↓ 16.8%	↓ 39.2%
2010	16,927.0	+ 413.2	↑ 2.5%	↓ 6.0%	**2010**	9,982.0	+ 1,779.8	↑ 21.7%	↓ 26.0%
2011	16,060.3	- 866.7	↓ 5.1%	↓ 10.9%	**2011**	8,995.4	- 986.7	↓ 9.9%	↓ 33.3%
2012	19,433.0	+ 3,372.7	↑ 21.0%	↑ 7.9%	**2012**	7,891.1	- 1,104.3	↓ 12.3%	↓ 41.5%
2013	21,229.7	+ 1,796.7	↑ 9.2%	↑ 17.8%	**2013**	9,704.1	+ 1,813.0	↑ 23.0%	↓ 28.1%
2014	17,402.8	- 3,827.0	↓ 18.0%	↓ 3.4%	**2014**	9,559.4	- 144.7	↓ 1.5%	↓ 29.1%
2015	17,657.2	+ 254.4	↑ 1.5%	↓ 2.0%	**2015**	9,357.5	- 202.0	↓ 2.1%	↓ 30.6%
2016	20,192.7	+ 2,535.5	↑ 14.4%	↑ 12.1%	**2016**	9,374.5	+ 17.0	↑ 0.2%	↓ 30.5%
2017	14,173.1	- 6,019.6	↓ 29.8%	↓ 21.3%	**2017**	9,130.6	- 243.9	↓ 2.6%	↓ 32.3%
2018	11,455.1	- 2,718.0	↓ 19.2%	↓ 36.4%	**2018**	8,500.0	- 630.6	↓ 6.9%	↓ 37.0%

Source: Data Adapted from StatsWales (2020)

Table N.3 – Wales's total carbon dioxide emissions [KtCO₂e] from transport and public between 1990 and 2018

Year	Transport[66]				Year	Public			
	Emissions ($KtCO_2e$)	Change	Per cent change			Emissions ($KtCO_2e$)	Change	Per cent change	
			Yearly	Overall				Yearly	Overall
1990	6,411.3				**1990**	769.2			
1995	6,431.4	+ 20.1		↑ 0.3%	**1995**	705.0	- 64.2		↓ 8.3%
1998	6,596.3	+ 164.9		↑ 2.9%	**1998**	566.5	- 138.4		↓ 26.3%
1999	6,597.3	+ 0.9	↑ 0.0%	↑ 2.9%	**1999**	576.8	+ 10.2	↑ 1.8%	↓ 25.0%
2000	6,461.1	- 136.2	↓ 2.1%	↑ 0.8%	**2000**	553.1	- 23.7	↓ 4.1%	↓ 28.1%
2001	6,475.2	+ 14.2	↑ 0.2%	↑ 1.0%	**2001**	543.0	- 10.1	↓ 1.8%	↓ 29.4%
2002	6,632.9	+ 157.7	↑ 2.4%	↑ 3.5%	**2002**	447.1	- 95.9	↓ 17.7%	↓ 41.9%
2003	6,585.6	- 47.3	↓ 0.7%	↑ 2.7%	**2003**	444.9	- 2.1	↓ 0.5%	↓ 42.2%
2004	6,780.7	+ 195.1	↑ 3.0%	↑ 5.8%	**2004**	498.3	+ 53.4	↑ 12.0%	↓ 35.2%
2005	6,782.5	+ 1.8	↑ 0.0%	↑ 5.8%	**2005**	516.9	+ 18.7	↑ 3.7%	↓ 32.8%
2006	6,784.5	+ 2.0	↑ 0.0%	↑ 5.8%	**2006**	456.9	- 60.1	↓ 11.6%	↓ 40.6%
2007	6,901.4	+ 116.8	↑ 1.7%	↑ 7.6%	**2007**	413.4	- 43.5	↓ 9.5%	↓ 46.3%
2008	6,677.2	- 224.2	↓ 3.2%	↑ 4.1%	**2008**	421.6	+ 8.2	↑ 2.0%	↓ 45.2%
2009	6,405.1	- 272.1	↓ 4.1%	↓ 0.1%	**2009**	377.6	- 44.0	↓ 10.4%	↓ 50.9%
2010	6,305.5	- 99.6	↓ 1.6%	↓ 1.6%	**2010**	398.5	+ 20.9	↑ 5.5%	↓ 48.2%
2011	6,223.6	- 81.9	↓ 1.3%	↓ 2.9%	**2011**	323.6	- 74.9	↓ 18.8%	↓ 57.9%
2012	6,043.8	- 179.8	↓ 2.9%	↓ 5.7%	**2012**	366.2	+ 42.6	↑ 13.2%	↓ 52.4%
2013	6,018.8	- 25.0	↓ 0.4%	↓ 6.1%	**2013**	368.3	+ 2.1	↑ 0.6%	↓ 52.1%
2014	6,100.8	+ 82.0	↑ 1.4%	↓ 4.8%	**2014**	307.6	- 60.7	↓ 16.5%	↓ 60.0%
2015	6,183.5	+ 82.7	↑ 1.4%	↓ 3.6%	**2015**	329.3	+ 21.7	↑ 7.1%	↓ 57.2%
2016	6,347.6	+ 164.1	↑ 2.7%	↓ 1.0%	**2016**	337.2	+ 7.9	↑ 2.4%	↓ 56.2%
2017	6,241.3	- 106.3	↓ 1.7%	↓ 2.7%	**2017**	310.7	- 26.5	↓ 7.9%	↓ 59.6%
2018	6,171.1	- 70.2	↓ 1.1%	↓ 3.7%	**2018**	324.6	+ 13.9	↑ 4.5%	↓ 57.8%

Source: Data Adapted from StatsWales (2020)

[66] - Excluding International

Table N.4 – Wales's total carbon dioxide emissions [$KtCO_2e$] from residential and agriculture between 1990 and 2018

Year	**Residential**				**Year**	**Agriculture**			
	Emissions ($KtCO_2e$)	**Change**	**Per cent change**			**Emissions ($KtCO_2e$)**	**Change**	**Per cent change**	
			Yearly	**Overall**				**Yearly**	**Overall**
1990	4,955.8				**1990**	6,321.8			
1995	5,135.3	+ 179.5		↑ 3.6%	**1995**	6,255.1	- 66.6		↓ 1.1%
1998	5,539.1	+ 403.8		↑ 11.8%	**1998**	6,273.0	+ 17.9		↓ 0.8%
1999	5,451.9	- 87.2	↓ 1.6%	↑ 10.0%	**1999**	6,391.5	+ 118.5	↑ 1.9%	↑ 1.1%
2000	5,270.3	- 181.6	↓ 3.3%	↑ 6.3%	**2000**	6,033.8	- 357.7	↓ 5.6%	↓ 4.6%
2001	5,373.3	+ 103.0	↑ 2.0%	↑ 8.4%	**2001**	5,878.3	- 155.5	↓ 2.6%	↓ 7.0%
2002	5,017.8	- 355.5	↓ 6.6%	↑ 1.3%	**2002**	5,694.0	- 184.3	↓ 3.1%	↓ 9.9%
2003	5,029.0	+ 11.2	↑ 0.2%	↑ 1.5%	**2003**	5,897.1	+ 203.0	↑ 3.6%	↓ 6.7%
2004	5,119.5	+ 90.6	↑ 1.8%	↑ 3.3%	**2004**	5,990.9	+ 93.8	↑ 1.6%	↓ 5.2%
2005	4,788.5	- 331.0	↓ 6.5%	↓ 3.4%	**2005**	5,788.4	- 202.5	↓ 3.4%	↓ 8.4%
2006	4,694.5	- 93.9	↓ 2.0%	↓ 5.3%	**2006**	5,573.2	- 215.2	↓ 3.7%	↓ 11.8%
2007	4,441.2	- 253.4	↓ 5.4%	↓ 10.4%	**2007**	5,437.3	- 136.0	↓ 2.4%	↓ 14.0%
2008	4,591.2	+ 150.0	↑ 3.4%	↓ 7.4%	**2008**	5,118.6	- 318.7	↓ 5.9%	↓ 19.0%
2009	4,388.9	- 202.2	↓ 4.4%	↓ 11.4%	**2009**	5,131.8	+ 13.2	↑ 0.3%	↓ 18.8%
2010	4,849.9	+ 461.0	↑ 10.5%	↓ 2.1%	**2010**	5,206.3	+ 74.5	↑ 1.5%	↓ 17.6%
2011	3,898.8	- 951.2	↓ 19.6%	↓ 21.3%	**2011**	5,211.7	+ 5.4	↑ 0.1%	↓ 17.6%
2012	4,207.5	+ 308.7	↑ 7.9%	↓ 15.1%	**2012**	5,184.7	- 27.0	↓ 0.5%	↓ 18.0%
2013	4,244.6	+ 37.1	↑ 0.9%	↓ 14.4%	**2013**	5,227.4	+ 42.7	↑ 0.8%	↓ 17.3%
2014	3,590.6	- 654.0	↓ 15.4%	↓ 27.5%	**2014**	5,466.7	+ 239.3	↑ 4.6%	↓ 13.5%
2015	3,650.1	+ 59.5	↑ 1.7%	↓ 26.3%	**2015**	5,317.0	- 149.6	↓ 2.7%	↓ 15.9%
2016	3,683.1	+ 33.0	↑ 0.9%	↓ 25.7%	**2016**	5,592.3	+ 275.3	↑ 5.2%	↓ 11.5%
2017	3,610.9	- 72.2	↓ 2.0%	↓ 27.1%	**2017**	5,634.1	+ 41.9	↑ 0.7%	↓ 10.9%
2018	3,699.3	+ 88.4	↑ 2.4%	↓ 25.4%	**2018**	5,600.3	- 33.8	↓ 0.6%	↓ 11.4%

Source: Data Adapted from StatsWales (2020)

Table N.5 – Wales's total carbon dioxide emissions [KtCO$_2$e] from industrial processes and waste management between 1990 and 2018

Year	Industrial Processes			
	Emissions (KtCO$_2$e)	Change	Per cent change	
			Yearly	Overall
1990	2,989.9			
1995	3,134.2	+ 144.3		↑ 4.8%
1998	2,980.7	- 153.5		↓ 0.3%
1999	3,284.2	+ 303.6	↑ 10.2%	↑ 9.8%
2000	3,319.4	+ 35.2	↑ 1.1%	↑ 11.0%
2001	2,556.5	- 763.0	↓ 23.0%	↓ 14.5%
2002	1,983.8	- 572.7	↓ 22.4%	↓ 33.6%
2003	2,578.1	+ 594.3	↑ 30.0%	↓ 13.8%
2004	2,669.2	+ 91.1	↑ 3.5%	↓ 10.7%
2005	2,739.9	+ 70.6	↑ 2.6%	↓ 8.4%
2006	2,731.4	- 8.4	↓ 0.3%	↓ 8.6%
2007	2,701.0	- 30.4	↓ 1.1%	↓ 9.7%
2008	2,444.6	- 256.5	↓ 9.5%	↓ 18.2%
2009	1,478.3	- 966.3	↓ 39.5%	↓ 50.6%
2010	2,093.6	+ 615.3	↑ 41.6%	↓ 30.0%
2011	1,937.3	- 156.3	↓ 7.5%	↓ 35.2%
2012	1,439.7	- 497.6	↓ 25.7%	↓ 51.8%
2013	2,844.1	+ 1,404.4	↑ 97.5%	↓ 4.9%
2014	3,034.3	+ 190.2	↑ 6.7%	↑ 1.5%
2015	2,770.7	- 263.6	↓ 8.7%	↓ 7.3%
2016	1,969.9	- 800.8	↓ 28.9%	↓ 34.1%
2017	2,005.1	+ 35.2	↑ 1.8%	↓ 32.9%
2018	1,867.1	- 138.0	↓ 6.9%	↓ 37.6%

Year	Waste Management			
	Emissions (KtCO$_2$e)	Change	Per cent change	
			Yearly	Overall
1990	3,281.8			
1995	3,447.7	+ 165.9		↑ 5.1%
1998	3,446.9	- 0.7		↑ 5.0%
1999	3,341.5	- 105.5	↓ 3.1%	↑ 1.8%
2000	3,252.5	- 89.0	↓ 2.7%	↓ 0.9%
2001	3,155.2	- 97.3	↓ 3.0%	↓ 3.9%
2002	3,095.7	- 59.5	↓ 1.9%	↓ 5.7%
2003	2,886.2	- 209.5	↓ 6.8%	↓ 12.1%
2004	2,769.4	- 116.7	↓ 4.0%	↓ 15.6%
2005	2,638.1	- 131.3	↓ 4.7%	↓ 19.6%
2006	2,499.3	- 138.8	↓ 5.3%	↓ 23.8%
2007	2,352.5	- 146.8	↓ 5.9%	↓ 28.3%
2008	2,003.4	- 349.1	↓ 14.8%	↓ 39.0%
2009	1,777.4	- 226.0	↓ 11.3%	↓ 45.8%
2010	1,662.6	- 114.8	↓ 6.5%	↓ 49.3%
2011	1,598.7	- 63.9	↓ 3.8%	↓ 51.3%
2012	1,490.2	- 108.5	↓ 6.8%	↓ 54.6%
2013	1,436.2	- 54.0	↓ 3.6%	↓ 56.2%
2014	1,298.0	- 138.2	↓ 9.6%	↓ 60.4%
2015	1,249.2	- 48.8	↓ 3.8%	↓ 61.9%
2016	1,259.6	+ 10.4	↑ 0.8%	↓ 61.6%
2017	1,258.2	- 1.5	↓ 0.1%	↓ 61.7%
2018	1,244.1	- 14.0	↓ 1.1%	↓ 62.1%

Source: Data Adapted from StatsWales (2020)

Table N.6 – Wales's total carbon dioxide emissions [$KtCO_2e$] from international aviation and shipping and LULUCF between 1990 and 2018

Year	International Aviation and Shipping				Year	LULUCF			
	Emissions ($KtCO_2e$)	Change	Per cent change			Emissions ($KtCO_2e$)	Change	Per cent change	
			Yearly	Overall				Yearly	Overall
1990	619.0				**1990**	- 424.4			
1995	576.7	- 42.2		↓ 6.8%	**1995**	- 521.9	- 97.5		↑ 23.0%
1998	694.2	+ 117.5		↑ 12.2%	**1998**	- 580.3	- 58.4		↑ 36.7%
1999	542.4	- 151.8	↓ 21.9%	↓ 12.4%	**1999**	- 295.1	+ 285.2	↓ 49.2%	↓ 30.5%
2000	521.5	- 20.9	↓ 3.9%	↓ 15.7%	**2000**	- 295.6	- 0.5	↑ 0.2%	↓ 30.4%
2001	544.9	+ 23.4	↑ 4.5%	↓ 12.0%	**2001**	- 349.1	- 53.5	↑ 18.1%	↓ 17.7%
2002	444.5	- 100.4	↓ 18.4%	↓ 28.2%	**2002**	- 409.8	- 60.7	↑ 17.4%	↓ 3.4%
2003	437.1	- 7.4	↓ 1.7%	↓ 29.4%	**2003**	- 435.3	- 25.5	↑ 6.2%	↑ 2.6%
2004	505.2	+ 68.1	↑ 15.6%	↓ 18.4%	**2004**	- 467.2	- 31.8	↑ 7.3%	↑ 10.1%
2005	469.7	- 35.4	↓ 7.0%	↓ 24.1%	**2005**	- 479.0	- 11.8	↑ 2.5%	↑ 12.9%
2006	536.6	+ 66.9	↑ 14.2%	↓ 13.3%	**2006**	- 513.2	- 34.2	↑ 7.1%	↑ 20.9%
2007	517.5	- 19.1	↓ 3.6%	↓ 16.4%	**2007**	- 562.5	- 49.3	↑ 9.6%	↑ 32.6%
2008	650.8	+ 133.3	↑ 25.8%	↑ 5.1%	**2008**	- 549.9	+ 12.6	↓ 2.2%	↑ 29.6%
2009	629.8	- 20.9	↓ 3.2%	↑ 1.8%	**2009**	- 590.8	- 40.8	↑ 7.4%	↑ 39.2%
2010	634.5	+ 4.7	↑ 0.7%	↑ 2.5%	**2010**	- 577.4	+ 13.3	↓ 2.3%	↑ 36.1%
2011	696.3	+ 61.9	↑ 9.8%	↑ 12.5%	**2011**	- 607.6	- 30.2	↑ 5.2%	↑ 43.2%
2012	551.5	- 144.8	↓ 20.8%	↓ 10.9%	**2012**	- 483.7	+ 123.9	↓ 20.4%	↑ 14.0%
2013	553.7	+ 2.2	↑ 0.4%	↓ 10.5%	**2013**	- 515.2	- 31.5	↑ 6.5%	↑ 21.4%
2014	525.3	- 28.4	↓ 5.1%	↓ 15.1%	**2014**	- 416.9	+ 98.4	↓ 19.1%	↓ 1.8%
2015	482.9	- 42.4	↓ 8.1%	↓ 22.0%	**2015**	- 452.5	- 35.6	↑ 8.5%	↑ 6.6%
2016	495.5	+ 12.6	↑ 2.6%	↓ 20.0%	**2016**	- 438.3	+ 14.2	↓ 3.1%	↑ 3.3%
2017	478.6	- 16.9	↓ 3.4%	↓ 22.7%	**2017**	- 441.7	- 3.4	↑ 0.8%	↑ 4.1%
2018	473.6	- 5.0	↓ 1.0%	↓ 23.5%	**2018**	- 443.7	- 2.0	↑ 0.5%	↑ 4.6%

Source: Data Adapted from StatsWales (2020)

Appendix O – United Kingdom's Greenhouse Gas Emissions Between 1990 and 2019

Table O.1 – United Kingdom's Total Greenhouse Gas Emissions (CO^2e) and CO^2 emissions between 1990 and 2019

Year	CO^2 Emissions				Year	Total Greenhouse Gas Emissions (CO^2e)			
	Emissions ($MtCO_2e$)	Change	Per cent change			Emissions ($MtCO_2e$)	Change	Per cent change	
			Yearly	Overall				Yearly	Overall
1990	595.7				**1990**	793.8			
1991	603.2	+ 7.5	↑ 1.3%	↑ 1.3%	**1991**	802.7	+ 8.9	↑ 1.1%	↑ 1.1%
1992	586.9	- 16.3	↓ 2.7%	↓ 1.5%	**1992**	781.1	- 21.6	↓ 2.7%	↓ 1.6%
1993	572.2	- 14.7	↓ 2.5%	↓ 3.9%	**1993**	761.2	- 19.9	↓ 2.5%	↓ 4.1%
1994	568.2	- 4.0	↓ 0.7%	↓ 4.6%	**1994**	752.0	- 9.2	↓ 1.2%	↓ 5.3%
1995	559.8	- 8.4	↓ 1.5%	↓ 6.0%	**1995**	745.4	- 6.6	↓ 0.9%	↓ 6.1%
1996	580.5	+ 20.7	↑ 3.7%	↓ 2.6%	**1996**	766.4	+ 21.0	↑ 2.8%	↓ 3.5%
1997	554.0	- 26.5	↓ 4.6%	↓ 7.0%	**1997**	740.6	- 25.8	↓ 3.4%	↓ 6.7%
1998	558.4	+ 4.4	↑ 0.8%	↓ 6.3%	**1998**	738.4	- 2.2	↓ 0.3%	↓ 7.0%
1999	552.1	- 6.3	↓ 1.1%	↓ 7.3%	**1999**	708.6	- 29.8	↓ 4.0%	↓ 10.7%
2000	558.5	+ 6.4	↑ 1.2%	↓ 6.2%	**2000**	707.9	- 0.7	↓ 0.1%	↓ 10.8%
2001	566.8	+ 8.3	↑ 1.5%	↓ 4.9%	**2001**	710.2	+ 2.3	↑ 0.3%	↓ 10.5%
2002	549.9	- 16.9	↓ 3.0%	↓ 7.7%	**2002**	689.7	- 20.5	↓ 2.9%	↓ 13.1%
2003	561.2	+ 11.3	↑ 2.1%	↓ 5.8%	**2003**	696.6	+ 6.9	↑ 1.0%	↓ 12.2%
2004	561.9	+ 0.7	↑ 0.1%	↓ 5.7%	**2004**	692.3	- 4.3	↓ 0.6%	↓ 12.8%
2005	558.1	- 3.8	↓ 0.7%	↓ 6.3%	**2005**	683.9	- 8.4	↓ 1.2%	↓ 13.8%
2006	555.1	- 3.0	↓ 0.5%	↓ 6.8%	**2006**	676.0	- 7.9	↓ 1.2%	↓ 14.8%
2007	546.2	- 8.9	↓ 1.6%	↓ 8.3%	**2007**	663.5	- 12.5	↓ 1.8%	↓ 16.4%
2008	531.4	- 14.8	↓ 2.7%	↓ 10.8%	**2008**	642.7	- 20.8	↓ 3.1%	↓ 19.0%
2009	481.0	- 50.4	↓ 9.5%	↓ 19.3%	**2009**	586.8	- 55.9	↓ 8.7%	↓ 26.1%
2010	498.5	+ 17.5	↑ 3.6%	↓ 16.3%	**2010**	600.9	+ 14.1	↑ 2.4%	↓ 24.3%
2011	455.7	- 42.8	↓ 8.6%	↓ 23.5%	**2011**	553.1	- 47.8	↓ 8.0%	↓ 30.3%
2012	473.9	+ 18.2	↑ 4.0%	↓ 20.5%	**2012**	570.1	+ 17.0	↑ 3.1%	↓ 28.2%
2013	463.8	- 10.1	↓ 2.1%	↓ 22.1%	**2013**	556.2	- 13.9	↓ 2.4%	↓ 29.9%
2014	425.0	- 38.8	↓ 8.4%	↓ 28.7%	**2014**	516.0	- 40.2	↓ 7.2%	↓ 35.0%
2015	408.3	- 16.7	↓ 3.9%	↓ 31.5%	**2015**	497.9	- 18.1	↓ 3.5%	↓ 37.3%
2016	385.1	- 23.2	↓ 5.7%	↓ 35.4%	**2016**	472.4	- 25.5	↓ 5.1%	↓ 40.5%
2017	373.8	- 11.3	↓ 2.9%	↓ 37.3%	**2017**	461.0	- 11.4	↓ 2.4%	↓ 41.9%
2018	365.7	- 8.1	↓ 2.2%	↓ 38.6%	**2018**	451.5	- 9.5	↓ 2.1%	↓ 43.1%
2019[1]	351.5	- 14.2	↓ 3.9%	↓ 41.0%	**2019**[67]	435.2	- 16.3	↓ 3.6%	↓ 45.2%

Source: Data Adapted from BEIS (2020a)

[67] - Provisional

Table O.2 – United Kingdom's total carbon dioxide emissions [$MtCO_2e$] from energy supply and business between 1990 and 2019

Year	Energy Supply				Year	Business			
	Emissions ($MtCO_2e$)	Change	Per cent change			Emissions ($MtCO_2e$)	Change	Per cent change	
			Yearly	Overall				Yearly	Overall
1990	242.1				**1990**	111.8			
1991	239.4	- 2.7	↓ 1.1%	↓ 1.1%	**1991**	117.3	+ 5.5	↑ 4.9%	↑ 4.9%
1992	228.4	- 11.0	↓ 4.6%	↓ 5.7%	**1992**	114.5	- 2.8	↓ 2.4%	↑ 2.4%
1993	212.7	- 15.7	↓ 6.9%	↓ 12.1%	**1993**	112.7	- 1.8	↓ 1.6%	↑ 0.8%
1994	211.1	- 1.6	↓ 0.8%	↓ 12.8%	**1994**	111.9	- 0.8	↓ 0.7%	↑ 0.1%
1995	210.2	- 0.9	↓ 0.4%	↓ 13.2%	**1995**	109.1	- 2.8	↓ 2.5%	↓ 2.4%
1996	212.5	+ 2.3	↑ 1.1%	↓ 12.2%	**1996**	111.2	+ 2.1	↑ 1.9%	↓ 0.5%
1997	198.4	- 14.1	↓ 6.6%	↓ 18.1%	**1997**	107.8	- 3.4	↓ 3.1%	↓ 3.6%
1998	203.6	+ 5.2	↑ 2.6%	↓ 15.9%	**1998**	107.1	- 0.7	↓ 0.6%	↓ 4.2%
1999	193.4	- 10.2	↓ 5.0%	↓ 20.1%	**1999**	109.6	+ 2.5	↑ 2.3%	↓ 2.0%
2000	204.0	+ 10.6	↑ 5.5%	↓ 15.7%	**2000**	109.1	- 0.5	↓ 0.5%	↓ 2.4%
2001	214.9	+ 10.9	↑ 5.3%	↓ 11.2%	**2001**	106.4	- 2.7	↓ 2.5%	↓ 4.8%
2002	212.9	- 2.0	↓ 0.9%	↓ 12.1%	**2002**	95.8	- 10.6	↓ 10.0%	↓ 14.3%
2003	220.3	+ 7.4	↑ 3.5%	↓ 9.0%	**2003**	98.4	+ 2.6	↑ 2.7%	↓ 12.0%
2004	218.4	- 1.9	↓ 0.9%	↓ 9.8%	**2004**	97.8	- 0.6	↓ 0.6%	↓ 12.5%
2005	219.1	+ 0.7	↑ 0.3%	↓ 9.5%	**2005**	97.2	- 0.6	↓ 0.6%	↓ 13.1%
2006	224.3	+ 5.2	↑ 2.4%	↓ 7.4%	**2006**	94.3	- 2.9	↓ 3.0%	↓ 15.7%
2007	219.3	- 5.0	↓ 2.2%	↓ 9.4%	**2007**	92.3	- 2.0	↓ 2.1%	↓ 17.4%
2008	213.0	- 6.3	↓ 2.9%	↓ 12.0%	**2008**	89.8	- 2.5	↓ 2.7%	↓ 19.7%
2009	190.0	- 23.0	↓ 10.8%	↓ 21.5%	**2009**	76.7	- 13.1	↓ 14.6%	↓ 31.4%
2010	197.3	+ 7.3	↑ 3.8%	↓ 18.5%	**2010**	78.4	+ 1.7	↑ 2.2%	↓ 29.9%
2011	182.9	- 14.4	↓ 7.3%	↓ 24.5%	**2011**	71.7	- 6.7	↓ 8.5%	↓ 35.9%
2012	193.4	+ 10.5	↑ 5.7%	↓ 20.1%	**2012**	73.1	+ 1.4	↑ 2.0%	↓ 34.6%
2013	181.5	- 11.9	↓ 6.2%	↓ 25.0%	**2013**	73.5	+ 0.4	↑ 0.5%	↓ 34.3%
2014	157.0	- 24.5	↓ 13.5%	↓ 35.2%	**2014**	71.2	- 2.3	↓ 3.1%	↓ 36.3%
2015	137.6	- 19.4	↓ 12.4%	↓ 43.2%	**2015**	69.6	- 1.6	↓ 2.2%	↓ 37.7%
2016	115.2	- 22.4	↓ 16.3%	↓ 52.4%	**2016**	66.8	- 2.8	↓ 4.0%	↓ 40.3%
2017	105.7	- 9.5	↓ 8.2%	↓ 56.3%	**2017**	67.1	+ 0.3	↑ 0.4%	↓ 40.0%
2018	98.4	- 7.3	↓ 6.9%	↓ 59.4%	**2018**	65.9	- 1.2	↓ 1.8%	↓ 41.1%
2019[2]	90.1	- 8.3	↓ 8.4%	↓ 62.8%	**2019**[68]	64.7	- 1.2	↓ 1.8%	↓ 42.1%

Source: Data Adapted from BEIS (2020a)

[68] - Provisional

Table O.3 – United Kingdom's total carbon dioxide emissions [$MtCO_2e$] from transport and public between 1990 and 2019

Year	Transport				Year	Public			
	Emissions ($MtCO_2e$)	Change	Per cent change			Emissions ($MtCO_2e$)	Change	Per cent change	
			Yearly	Overall				Yearly	Overall
1990	125.4				**1990**	13.4			
1991	123.6	- 1.8	↓ 1.4%	↓ 1.4%	**1991**	14.3	+ 0.9	↑ 6.7%	↑ 6.7%
1992	124.8	+ 1.2	↑ 1.0%	↓ 0.5%	**1992**	15.0	+ 0.7	↑ 4.9%	↑ 11.9%
1993	126.2	+ 1.4	↑ 1.1%	↑ 0.6%	**1993**	13.7	- 1.3	↓ 8.7%	↑ 2.2%
1994	127.4	+ 1.2	↑ 1.0%	↑ 1.6%	**1994**	13.4	- 0.3	↓ 2.2%	= 0.0%
1995	126.8	- 0.6	↓ 0.5%	↑ 1.1%	**1995**	13.2	- 0.2	↓ 1.5%	↓ 1.5%
1996	131.2	+ 4.4	↑ 3.5%	↑ 4.6%	**1996**	14.2	+ 1.0	↑ 7.6%	↑ 6.0%
1997	132.3	+ 1.1	↑ 0.8%	↑ 5.5%	**1997**	13.8	- 0.4	↓ 2.8%	↑ 3.0%
1998	131.6	- 0.7	↓ 0.7%	↑ 4.9%	**1998**	12.9	- 0.9	↓ 6.5%	↓ 3.7%
1999	132.7	+ 1.1	↑ 0.8%	↑ 5.8%	**1999**	12.8	- 0.1	↓ 0.8%	↓ 4.5%
2000	131.0	- 1.7	↓ 1.3%	↑ 4.5%	**2000**	12.1	- 0.7	↓ 5.5%	↓ 9.7%
2001	130.7	- 0.3	↓ 0.2%	↑ 4.2%	**2001**	12.2	+ 0.1	↑ 0.8%	↓ 9.0%
2002	133.3	+ 2.6	↑ 2.0%	↑ 6.3%	**2002**	10.3	- 1.9	↓ 15.6%	↓ 23.1%
2003	132.6	- 0.7	↓ 0.5%	↑ 5.7%	**2003**	10.2	- 0.1	↓ 1.0%	↓ 23.9%
2004	133.6	+ 1.0	↑ 0.8%	↑ 6.5%	**2004**	11.2	+ 1.0	↑ 9.8%	↓ 16.4%
2005	134.3	+ 0.7	↑ 0.5%	↑ 7.1%	**2005**	11.1	- 0.1	↓ 0.9%	↓ 17.2%
2006	134.4	+ 0.1	↑ 0.1%	↑ 7.2%	**2006**	10.1	- 1.0	↓ 9.0%	↓ 24.6%
2007	136.0	+ 1.6	↑ 1.2%	↑ 8.5%	**2007**	9.4	- 0.7	↓ 6.9%	↓ 29.9%
2008	130.1	- 5.9	↓ 4.3%	↑ 3.7%	**2008**	9.7	+ 0.3	↑ 3.2%	↓ 27.6%
2009	125.2	- 4.9	↓ 3.8%	↓ 0.2%	**2009**	8.8	- 0.9	↓ 9.3%	↓ 34.3%
2010	123.4	- 1.8	↓ 1.4%	↓ 1.6%	**2010**	9.5	+ 0.7	↑ 8.0%	↓ 29.1%
2011	121.2	- 2.2	↓ 1.8%	↓ 3.3%	**2011**	8.0	- 1.5	↓ 15.8%	↓ 40.3%
2012	120.3	- 0.9	↓ 0.7%	↓ 4.1%	**2012**	8.9	+ 0.9	↑ 11.3%	↓ 33.6%
2013	118.8	- 1.5	↓ 1.2%	↓ 5.3%	**2013**	9.1	+ 0.2	↑ 2.2%	↓ 32.1%
2014	120.1	+ 1.3	↑ 1.1%	↓ 4.2%	**2014**	7.8	- 1.3	↓ 14.3%	↓ 41.8%
2015	122.2	+ 2.1	↑ 1.7%	↓ 2.6%	**2015**	8.0	+ 0.2	↑ 2.6%	↓ 40.3%
2016	124.6	+ 2.4	↑ 2.0%	↓ 0.6%	**2016**	8.1	+ 0.1	↑ 1.3%	↓ 39.6%
2017	124.8	+ 0.2	↑ 0.2%	↓ 0.5%	**2017**	7.7	- 0.4	↓ 4.9%	↓ 42.5%
2018	123.0	- 1.8	↓ 1.4%	↓ 1.9%	**2018**	8.0	+ 0.3	↑ 3.9%	↓ 40.3%
2019[2]	119.6	- 3.4	↓ 2.8%	↓ 4.6%	**2019[69]**	8.0	= 0.0	= 0.0%	↓ 40.3%

Source: Data Adapted from BEIS (2020a)

[69] - Provisional

Table O.4 – United Kingdom's total carbon dioxide emissions [$MtCO_2e$] from residential and agriculture between 1990 and 2019

Year	Residential				Year	Agriculture			
	Emissions ($MtCO_2e$)	Change	Per cent change			Emissions ($MtCO_2e$)	Change	Per cent change	
			Yearly	Overall				Yearly	Overall
1990	78.3				**1990**	6.5			
1991	87.0	+ 8.7	↑ 11.1%	↑ 11.1%	**1991**	6.5	= 0.0	= 0.0%	= 0.0%
1992	84.4	- 2.6	↓ 3.0%	↑ 7.8%	**1992**	6.5	= 0.0	= 0.0%	= 0.0%
1993	88.4	+ 4.0	↑ 4.7%	↑ 12.9%	**1993**	6.1	- 0.4	↓ 6.2%	↓ 6.2%
1994	84.0	- 4.4	↓ 5.0%	↑ 7.3%	**1994**	6.5	+ 0.4	↑ 6.6%	= 0.0%
1995	79.6	- 4.4	↓ 5.2%	↑ 1.7%	**1995**	6.5	= 0.0	= 0.0%	= 0.0%
1996	90.8	+ 11.2	↑ 14.1%	↑ 16.0%	**1996**	6.6	+ 0.1	↑ 1.5%	↑ 1.5%
1997	83.6	- 7.2	↓ 7.9%	↑ 6.8%	**1997**	5.8	- 0.8	↓ 12.1%	↓ 10.8%
1998	85.5	+ 1.9	↑ 2.3%	↑ 9.2%	**1998**	6.0	+ 0.2	↑ 3.4%	↓ 7.7%
1999	85.3	- 0.2	↓ 0.2%	↑ 8.9%	**1999**	6.2	+ 0.2	↑ 3.3%	↓ 4.6%
2000	85.6	+ 0.3	↑ 0.4%	↑ 9.3%	**2000**	5.5	- 0.7	↓ 11.3%	↓ 15.4%
2001	87.8	+ 2.2	↑ 2.6%	↑ 12.1%	**2001**	5.4	- 0.1	↓ 1.8%	↓ 16.9%
2002	84.4	- 3.4	↓ 3.9%	↑ 7.8%	**2002**	5.5	+ 0.1	↑ 1.9%	↓ 15.4%
2003	85.3	+ 0.9	↑ 1.1%	↑ 8.9%	**2003**	6.2	+ 0.7	↑ 12.7%	↓ 4.6%
2004	86.9	+ 1.6	↑ 1.9%	↑ 11.0%	**2004**	6.2	= 0.0	= 0.0%	↓ 4.6%
2005	82.4	- 4.5	↓ 5.2%	↑ 5.2%	**2005**	6.1	- 0.1	↓ 1.6%	↓ 6.2%
2006	79.8	- 2.6	↓ 3.2%	↑ 1.9%	**2006**	5.9	- 0.2	↓ 3.3%	↓ 9.2%
2007	76.3	- 3.5	↓ 4.4%	↓ 2.6%	**2007**	5.7	- 0.2	↓ 3.4%	↓ 12.3%
2008	78.2	+ 1.9	↑ 2.5%	↓ 0.1%	**2008**	5.5	- 0.2	↓ 3.5%	↓ 15.4%
2009	75.0	- 3.2	↓ 4.1%	↓ 4.2%	**2009**	5.4	- 0.1	↓ 1.8%	↓ 16.9%
2010	84.5	+ 9.5	↑ 12.7%	↑ 7.9%	**2010**	5.4	= 0.0	= 0.0%	↓ 16.9%
2011	67.3	- 17.2	↓ 20.4%	↓ 14.0%	**2011**	5.6	+ 0.2	↑ 3.7%	↓ 13.8%
2012	73.6	+ 6.3	↑ 9.4%	↓ 6.0%	**2012**	5.4	- 0.2	↓ 3.6%	↓ 16.9%
2013	74.5	+ 0.9	↑ 1.2%	↓ 4.9%	**2013**	5.2	- 0.2	↓ 3.7%	↓ 20.0%
2014	62.0	- 12.5	↓ 16.8%	↓ 20.8%	**2014**	5.6	+ 0.4	↑ 7.7%	↓ 13.8%
2015	64.5	+ 2.5	↑ 4.0%	↓ 17.6%	**2015**	5.5	- 0.1	↓ 1.8%	↓ 15.4%
2016	65.8	+ 1.3	↑ 2.0%	↓ 16.0%	**2016**	5.7	+ 0.2	↑ 3.6%	↓ 12.3%
2017	63.8	- 2.0	↓ 3.0%	↓ 18.5%	**2017**	5.8	+ 0.1	↑ 1.8%	↓ 10.8%
2018	66.4	+ 2.6	↑ 4.1%	↓ 15.2%	**2018**	5.7	- 0.1	↓ 1.7%	↓ 12.3%
2019[2]	65.2	- 1.2	↓ 1.8%	↓ 16.7%	**2019**[70]	5.7	= 0.0	= 0.0%	↓ 12.3%

Source: Data Adapted from BEIS (2020a)

[70] - Provisional

Table O.5 – United Kingdom's total carbon dioxide emissions [$MtCO_2e$] from industrial processes and waste management between 1990 and 2019

Year	Industrial Processes				Year	Waste Management			
	Emissions ($MtCO_2e$)	Change	Per cent change			Emissions ($MtCO_2e$)	Change	Per cent change	
			Yearly	Overall				Yearly	Overall
1990	19.4				**1990**	1.3			
1991	16.8	- 2.6	↓ 13.4%	↓ 1.4%	**1991**	1.3	= 0.0	= 0.0%	= 0.0%
1992	15.8	- 1.0	↓ 6.0%	↓ 18.6%	**1992**	1.3	= 0.0	= 0.0%	= 0.0%
1993	15.5	- 0.3	↓ 1.9%	↓ 20.1%	**1993**	1.2	- 0.1	↓ 7.7%	↓ 7.7%
1994	17.2	+ 1.7	↑ 11.0%	↓ 11.3%	**1994**	1.0	- 0.2	↓ 16.7%	↓ 23.1%
1995	17.8	+ 0.6	↑ 3.5%	↓ 8.2%	**1995**	1.0	= 0.0	= 0.0%	↓ 23.1%
1996	18.3	+ 0.5	↑ 2.8%	↓ 5.7%	**1996**	1.0	= 0.0	= 0.0%	↓ 23.1%
1997	17.5	- 0.8	↓ 4.4%	↓ 9.8%	**1997**	0.6	- 0.4	↓ 40.0%	↓ 53.8%
1998	17.5	= 0.0	= 0.0%	↓ 9.8%	**1998**	0.6	= 0.0	= 0.0%	↓ 53.8%
1999	17.6	+ 0.1	↑ 0.6%	↓ 9.3%	**1999**	0.6	= 0.0	= 0.0%	↓ 53.8%
2000	17.0	- 0.6	↓ 3.4%	↓ 12.4%	**2000**	0.6	= 0.0	= 0.0%	↓ 53.8%
2001	15.7	- 1.3	↓ 7.6%	↓ 19.1%	**2001**	0.6	= 0.0	= 0.0%	↓ 53.8%
2002	14.9	- 0.8	↓ 5.1%	↓ 23.2%	**2002**	0.5	- 0.1	↓ 16.7%	↓ 61.5%
2003	15.7	+ 0.8	↑ 5.4%	↓ 19.1%	**2003**	0.5	= 0.0	= 0.0%	↓ 61.5%
2004	16.1	+ 0.4	↑ 2.5%	↓ 17.0%	**2004**	0.5	= 0.0	= 0.0%	↓ 61.5%
2005	16.4	+ 0.3	↑ 1.9%	↓ 15.5%	**2005**	0.4	- 0.1	↓ 20.0%	↓ 69.2%
2006	15.6	- 0.8	↓ 4.9%	↓ 19.6%	**2006**	0.3	- 0.1	↓ 25.0%	↓ 76.9%
2007	16.9	+ 1.3	↑ 8.3%	↓ 12.9%	**2007**	0.4	+ 0.1	↑ 33.3%	↓ 69.2%
2008	15.3	- 1.6	↓ 9.5%	↓ 21.1%	**2008**	0.3	- 0.1	↓ 25.0%	↓ 76.9%
2009	10.1	- 5.2	↓ 34.0%	↓ 47.9%	**2009**	0.3	= 0.0	= 0.0%	↓ 76.9%
2010	10.6	+ 0.5	↑ 5.0%	↓ 45.4%	**2010**	0.3	= 0.0	= 0.0%	↓ 76.9%
2011	10.1	- 0.5	↓ 4.7%	↓ 47.9%	**2011**	0.3	= 0.0	= 0.0%	↓ 76.9%
2012	10.0	- 0.1	↓ 1.0%	↓ 48.5%	**2012**	0.3	= 0.0	= 0.0%	↓ 76.9%
2013	12.3	+ 2.3	↑ 23.0%	↓ 36.6%	**2013**	0.3	= 0.0	= 0.0%	↓ 76.9%
2014	12.4	+ 0.1	↑ 0.8%	↓ 36.1%	**2014**	0.3	= 0.0	= 0.0%	↓ 76.9%
2015	12.1	- 0.3	↓ 2.4%	↓ 37.6%	**2015**	0.2	- 0.1	↓ 33.3%	↓ 84.6%
2016	10.0	-2.1	↓ 17.4%	↓ 48.5%	**2016**	0.3	+ 0.1	↑ 50.0%	↓ 76.9%
2017	10.2	+ 0.2	↑ 2.0%	↓ 47.4%	**2017**	0.2	- 0.1	↓ 33.3%	↓ 84.6%
2018	9.7	- 0.5	↓ 4.9%	↓ 50.0%	**2018**	0.2	= 0.0	= 0.0%	↓ 84.6%
2019[2]	9.7	= 0.0	= 0.0%	↓ 50.0%	**2019**[71]	0.2	= 0.0	= 0.0%	↓ 84.6%

Source: Data Adapted from BEIS (2020a)

[71] - Provisional

Table O.6 – United Kingdom's total carbon dioxide emissions [$MtCO_2e$] from LULUCF between 1990 and 2019

Year	LULUCF			
	Emissions ($MtCO_2e$)	Change	Per cent change	
			Yearly	Overall
1990	- 2.4			
1991	- 2.9	- 0.5	↑ 20.8%	↑ 20.8%
1992	- 3.7	- 0.8	↑ 27.6%	↑ 54.2%
1993	- 4.2	- 0.5	↑ 13.5%	↑ 75.0%
1994	- 4.4	- 0.2	↑ 4.8%	↑ 83.3%
1995	- 4.5	- 0.1	↑ 2.3%	↑ 87.5%
1996	- 5.3	- 0.8	↑ 17.8%	↑ 120.8%
1997	- 5.8	- 0.5	↑ 9.4%	↑ 141.7%
1998	- 6.5	- 0.7	↑ 12.1%	↑ 170.8%
1999	- 6.0	+ 0.5	↓ 7.7%	↑ 150.0%
2000	- 6.3	- 0.3	↑ 5.0%	↑ 162.5%
2001	- 6.9	- 0.6	↑ 9.5%	↑ 187.5%
2002	- 7.8	- 0.7	↑ 13.0%	↑ 225.0%
2003	- 8.0	- 0.2	↑ 2.6%	↑ 233.3%
2004	- 8.7	- 0.7	↑ 8.7%	↑ 262.5%
2005	- 9.1	- 0.4	↑ 4.6%	↑ 279.2%
2006	- 9.6	- 0.5	↑ 5.5%	↑ 300.0%
2007	- 10.1	- 0.5	↑ 5.2%	↑ 320.8%
2008	- 10.6	- 0.5	↑ 5.0%	↑ 341.7%
2009	- 10.6	= 0.0	= 0.0%	↑ 341.7%
2010	- 10.9	- 0.3	↑ 2.8%	↑ 354.2%
2011	- 11.4	- 0.5	↑ 4.6%	↑ 375.0%
2012	- 11.2	+ 0.2	↓ 1.8%	↑ 366.7%
2013	- 11.3	- 0.1	↑ 0.9%	↑ 370.8%
2014	- 11.2	+ 0.1	↓ 0.9%	↑ 366.7%
2015	- 11.4	- 0.2	↑ 1.8%	↑ 375.0%
2016	- 11.3	+ 0.1	↓ 0.9%	↑ 370.8%
2017	- 11.5	- 0.2	↑ 1.8%	↑ 379.2%
2018	- 11.7	- 0.2	↑ 1.7%	↑ 387.5%
2019[72]	- 11.7	= 0.0	= 0.0%	↑ 387.5%

Source: Data Adapted from BEIS (2020a)

[72] - Provisional

Appendix P – England's Greenhouse Gas Emissions

Table P.1 – England's Total Greenhouse Gas Emissions (MtCO²e) between 1990 and 2018

Year	Total Greenhouse Gas Emissions (CO²e)			
	Emissions ($MtCO_2e$)	Change	Per cent change	
			Yearly	Overall
1990	623.8			
1995	573.0	- 50.8		↓ 8.1%
1998	563.5	- 9.5		↓ 9.7%
1999	534.8	- 28.7	↓ 5.1%	↓ 14.3%
2000	532.1	- 2.8	↓ 0.5%	↓ 14.7%
2001	538.1	+ 6.1	↑ 1.1%	↓ 13.7%
2002	529.9	- 8.2	↓ 1.5%	↓ 15.1%
2003	536.6	+ 6.7	↑ 1.3%	↓ 14.0%
2004	531.8	- 4.8	↓ 0.9%	↓ 14.7%
2005	527.2	- 4.7	↓ 0.9%	↓ 15.5%
2006	516.9	- 10.3	↓ 2.0%	↓ 17.1%
2007	513.0	- 3.9	↓ 0.8%	↓ 17.8%
2008	494.5	- 18.5	↓ 3.6%	↓ 20.7%
2009	450.4	- 44.1	↓ 8.9%	↓ 27.8%
2010	458.1	+ 7.7	↑ 1.7%	↓ 26.6%
2011	423.4	- 34.7	↓ 7.6%	↓ 32.1%
2012	438.2	+ 14.8	↑ 3.5%	↓ 29.7%
2013	421.4	- 16.8	↓ 3.8%	↓ 32.4%
2014	390.1	- 31.3	↓ 7.4%	↓ 37.5%
2015	372.2	- 18.0	↓ 4.6%	↓ 40.3%
2016	348.5	- 23.6	↓ 6.3%	↓ 44.1%
2017	344.7	- 3.9	↓ 1.1%	↓ 44.7%
2018	338.7	- 6.0	↓ 1.7%	↓ 45.7%

Source: Data Adapted from Thistlethwaite *et al.* (2020)

Table P.2 – England's total carbon dioxide emissions [$KtCO_2e$] from energy supply and business between 1990 and 2018

Year	Energy Supply				Year	Business			
	Emissions ($KtCO_2e$)	Change	Per cent change			Emissions ($KtCO_2e$)	Change	Per cent change	
			Yearly	Overall				Yearly	Overall
1990	216,828.3				**1990**	84,863.1			
1995	171,756.7	- 45,071.6		↓ 20.8%	**1995**	84,109.0	- 754.1		↓ 0.9%
1998	156,890.8	- 14,866.0		↓ 27.6%	**1998**	84,113.4	4.5		↓ 0.9%
1999	147,477.5	- 9,413.3	↓ 6.0%	↓ 32.0%	**1999**	85,075.1	961.7	↑ 1.1%	↑ 0.2%
2000	151,705.2	+ 4,227.7	↑ 2.9%	↓ 30.0%	**2000**	85,675.5	600.4	↑ 0.7%	↑ 1.0%
2001	160,503.5	+ 8,798.3	↑ 5.8%	↓ 26.0%	**2001**	86,871.2	1,195.7	↑ 1.4%	↑ 2.4%
2002	162,276.7	+ 1,773.1	↑ 1.1%	↓ 25.2%	**2002**	82,904.9	- 3,966.4	↓ 4.6%	↓ 2.3%
2003	170,124.5	+ 7,847.9	↑ 4.8%	↓ 21.5%	**2003**	85,084.9	2,180.1	↑ 2.6%	↑ 0.3%
2004	167,498.4	- 2,626.2	↓ 1.5%	↓ 22.8%	**2004**	84,936.0	- 149.0	↓ 0.2%	↑ 0.1%
2005	168,101.6	+ 603.3	↑ 0.4%	↓ 22.5%	**2005**	86,079.6	1,143.7	↑ 1.3%	↑ 1.4%
2006	168,257.1	+ 155.5	↑ 0.1%	↓ 22.4%	**2006**	83,904.6	- 2,175.1	↓ 2.5%	↓ 1.1%
2007	169,659.3	+ 1,402.1	↑ 0.8%	↓ 21.8%	**2007**	83,281.8	- 622.7	↓ 0.7%	↓ 1.9%
2008	162,138.6	- 7,520.7	↓ 4.4%	↓ 25.2%	**2008**	81,676.4	- 1,605.4	↓ 1.9%	↓ 3.8%
2009	144,358.7	- 17,779.9	↓ 11.0%	↓ 33.4%	**2009**	72,071.2	- 9,605.3	↓ 11.8%	↓ 15.1%
2010	148,556.7	+ 4,198.0	↑ 2.9%	↓ 31.5%	**2010**	72,601.6	530.5	↑ 0.7%	↓ 14.4%
2011	140,525.8	- 8,030.9	↓ 5.4%	↓ 35.2%	**2011**	65,943.3	- 6,658.3	↓ 9.2%	↓ 22.3%
2012	147,832.0	+ 7,306.2	↑ 5.2%	↓ 31.8%	**2012**	69,119.9	3,176.6	↑ 4.8%	↓ 18.6%
2013	134,518.3	- 13,313.7	↓ 9.0%	↓ 38.0%	**2013**	67,980.2	- 1,139.7	↓ 1.6%	↓ 19.9%
2014	116,035.6	- 18,482.7	↓ 13.7%	↓ 46.5%	**2014**	66,494.2	- 1,486.0	↓ 2.2%	↓ 21.6%
2015	96,639.3	- 19,396.3	↓ 16.7%	↓ 55.4%	**2015**	65,042.7	- 1,451.5	↓ 2.2%	↓ 23.4%
2016	75,426.7	- 21,212.6	↓ 22.0%	↓ 65.2%	**2016**	61,564.7	- 3,478.0	↓ 5.3%	↓ 27.5%
2017	73,295.2	- 2,131.5	↓ 2.8%	↓ 66.2%	**2017**	61,022.7	-542.0	↓ 0.9%	↓ 28.1%
2018	68,545.7	- 4,749.5	↓ 6.5%	↓ 68.4%	**2018**	59,771.5	- 1,251.2	↓ 2.1%	↓ 29.6%

Source: Data Adapted from Thistlethwaite *et al.* (2020)

Table P.3 – England's total carbon dioxide emissions [$KtCO_2e$] from transport and public between 1990 and 2018

Year	Transport[73]				Year	Public			
	Emissions ($KtCO_2e$)	Change	Per cent change			Emissions ($KtCO_2e$)	Change	Per cent change	
			Yearly	Overall				Yearly	Overall
1990	104,682.2				**1990**	10,529.5			
1995	105,221.4	539.2		↑ 0.5%	**1995**	10,432.5	- 97.0		↓ 0.9%
1998	108,787.5	3,566.1		↑ 3.9%	**1998**	10,352.1	- 80.4		↓ 1.7%
1999	109,576.2	788.7	↑ 0.7%	↑ 4.7%	**1999**	10,316.2	- 35.8	↓ 0.3%	↓ 2.0%
2000	108,338.9	- 1,237.3	↓ 1.1%	↑ 3.5%	**2000**	9,710.1	- 606.1	↓ 5.9%	↓ 7.8%
2001	108,070.1	- 268.8	↓ 0.2%	↑ 3.2%	**2001**	9,798.9	88.7	↑ 0.9%	↓ 6.9%
2002	109,741.0	1,670.9	↑ 1.5%	↑ 4.8%	**2002**	8,315.1	- 1,483.8	↓ 15.1%	↓ 21.0%
2003	108,885.0	-856.0	↓ 0.8%	↑ 4.0%	**2003**	8,254.1	- 60.9	↓ 0.7%	↓ 21.6%
2004	109,675.1	790.1	↑ 0.7%	↑ 4.8%	**2004**	8,990.7	736.5	↑ 8.9%	↓ 14.6%
2005	110,134.9	459.7	↑ 0.4%	↑ 5.2%	**2005**	8,942.8	- 47.9	↓ 0.5%	↓ 15.1%
2006	110,237.0	102.1	↑ 0.1%	↑ 5.3%	**2006**	8,082.8	- 859.9	↓ 9.6%	↓ 23.2%
2007	111,216.0	979.1	↑ 0.9%	↑ 6.2%	**2007**	7,530.0	- 552.8	↓ 6.8%	↓ 28.5%
2008	106,150.4	- 5,065.7	↓ 4.6%	↑ 1.4%	**2008**	7,784.1	254.0	↑ 3.4%	↓ 26.1%
2009	101,962.2	- 4,188.2	↓ 3.9%	↓ 2.6%	**2009**	7,097.3	- 686.8	↓ 8.8%	↓ 32.6%
2010	100,645.3	- 1,316.9	↓ 1.3%	↓ 3.9%	**2010**	7,638.4	541.2	↑ 7.6%	↓ 27.5%
2011	99,278.8	- 1,366.4	↓ 1.4%	↓ 5.2%	**2011**	6,435.6	- 1,202.8	↓ 15.7%	↓ 38.9%
2012	98,690.3	- 588.5	↓ 0.6%	↓ 5.7%	**2012**	7,188.5	752.8	↑ 11.7%	↓ 31.7%
2013	97,439.5	- 1,250.9	↓ 1.3%	↓ 6.9%	**2013**	7,365.2	176.8	↑ 2.5%	↓ 30.1%
2014	98,712.9	1,273.5	↑ 1.3%	↓ 5.7%	**2014**	6,280.5	- 1,084.7	↓ 14.7%	↓ 40.4%
2015	100,471.6	1,758.7	↑ 1.8%	↓ 4.0%	**2015**	6,373.3	92.8	↑ 1.5%	↓ 39.5%
2016	102,292.0	1,820.3	↑ 1.8%	↓ 2.3%	**2016**	6,492.5	119.2	↑ 1.9%	↓ 38.3%
2017	102,302.2	10.2	↑ 0.0%	↓ 2.3%	**2017**	6,222.9	- 269.6	↓ 4.2%	↓ 40.9%
2018	100,817.3	- 1,484.9	↓ 1.5%	↓ 3.7%	**2018**	6,435.5	212.6	↑ 3.4%	↓ 38.9%

Source: Data Adapted from Thistlethwaite *et al.* (2020)

[73] - Excluding International

Table P.4 – England's total carbon dioxide emissions [KtCO_2e] from residential and agriculture between 1990 and 2018

Year	Residential				Year	Agriculture			
	Emissions (KtCO_2e)	Change	Per cent change			Emissions (KtCO_2e)	Change	Per cent change	
			Yearly	Overall				Yearly	Overall
1990	63,446.3				**1990**	33,483.1			
1995	65,822.3	+ 2,376.0		↑ 3.7%	**1995**	32,023.7	- 1,459.3		↓ 4.4%
1998	72,365.7	+ 6,543.4		↑ 14.1%	**1998**	31,845.3	- 178.5		↓ 4.9%
1999	72,057.4	- 308.3	↓ 0.4%	↑ 13.6%	**1999**	31,873.3	+ 28.0	↑ 0.1%	↓ 4.8%
2000	72,718.1	+ 660.7	↑ 0.9%	↑ 14.6%	**2000**	30,221.9	- 1,651.4	↓ 5.2%	↓ 9.7%
2001	74,600.7	+ 1,882.6	↑ 2.6%	↑ 17.6%	**2001**	28,294.9	- 1,927.0	↓ 6.4%	↓ 15.5%
2002	71,837.0	- 2,763.8	↓ 3.7%	↑ 13.2%	**2002**	28,197.3	- 97.7	↓ 0.3%	↓ 15.8%
2003	72,796.2	+ 959.3	↑ 1.3%	↑ 14.7%	**2003**	28,731.5	+ 534.2	↑ 1.9%	↓ 14.2%
2004	74,176.1	+ 1,379.8	↑ 1.9%	↑ 16.9%	**2004**	28,713.3	- 18.2	↓ 0.1%	↓ 14.2%
2005	70,583.5	- 3,592.6	↓ 4.8%	↑ 11.2%	**2005**	28,445.8	- 267.5	↓ 0.9%	↓ 15.0%
2006	68,089.6	- 2,493.9	↓ 3.5%	↑ 7.3%	**2006**	27,724.9	- 720.9	↓ 2.5%	↓ 17.2%
2007	65,028.8	- 3,060.8	↓ 4.5%	↑ 2.5%	**2007**	27,120.5	- 604.4	↓ 2.2%	↓ 19.0%
2008	66,531.2	+ 1,502.4	↑ 2.3%	↑ 4.9%	**2008**	26,851.9	- 268.6	↓ 1.0%	↓ 19.8%
2009	63,689.8	- 2,841.4	↓ 4.3%	↑ 0.4%	**2009**	26,605.7	- 246.2	↓ 0.9%	↓ 20.5%
2010	71,494.7	+ 7,804.9	↑ 12.3%	↑ 12.7%	**2010**	26,592.5	- 13.2	↓ 0.0%	↓ 20.6%
2011	57,181.0	- 14,313.6	↓ 20.0%	↓ 9.9%	**2011**	26,739.5	+ 147.0	↑ 0.6%	↓ 20.1%
2012	62,754.9	+ 5,573.9	↑ 9.7%	↓ 1.1%	**2012**	26,495.2	- 244.3	↓ 0.9%	↓ 20.9%
2013	63,335.1	+ 580.2	↑ 0.9%	↓ 0.2%	**2013**	26,262.9	- 232.3	↓ 0.9%	↓ 21.6%
2014	52,843.7	- 10,491.5	↓ 16.6%	↓ 16.7%	**2014**	27,262.8	+ 999.9	↑ 3.8%	↓ 18.6%
2015	55,037.0	+ 2,193.4	↑ 4.2%	↓ 13.3%	**2015**	27,006.2	- 256.6	↓ 0.9%	↓ 19.3%
2016	56,113.4	+ 1,076.4	↑ 2.0%	↓ 11.6%	**2016**	26,828.5	- 177.7	↓ 0.7%	↓ 19.9%
2017	54,355.2	- 1,758.2	↓ 3.1%	↓ 14.3%	**2017**	27,162.9	+ 334.4	↑ 1.2%	↓ 18.9%
2018	56,455.7	+ 2,100.5	↑ 3.9%	↓ 11.0%	**2018**	27,005.6	- 157.4	↓ 0.6%	↓ 19.3%

Source: Data Adapted from Thistlethwaite *et al.* (2020)

Table P.5 – England's total carbon dioxide emissions [$KtCO_2e$] from industrial processes and waste management between 1990 and 2018

Year	Industrial Processes				Year	Waste Management			
	Emissions ($KtCO_2e$)	Change	Per cent change			Emissions ($KtCO_2e$)	Change	Per cent change	
			Yearly	Overall				Yearly	Overall
1990	54,251.0				**1990**	55,460.7			
1995	46,456.4	- 7,794.5		↓ 14.4%	**1995**	57,591.8	2,131.1		↑ 3.8%
1998	43,992.3	- 2,464.1		↓ 18.9%	**1998**	56,497.3	- 1,094.5		↑ 1.9%
1999	25,148.7	- 18,843.6	↓ 42.8%	↓ 53.6%	**1999**	54,123.0	- 2,374.4	↓ 4.2%	↓ 2.4%
2000	22,599.3	- 2,549.4	↓ 10.1%	↓ 58.3%	**2000**	52,018.1	- 2,104.9	↓ 3.9%	↓ 6.2%
2001	20,828.7	- 1,770.6	↓ 7.8%	↓ 61.6%	**2001**	50,375.7	- 1,642.4	↓ 3.2%	↓ 9.2%
2002	18,866.3	- 1,962.3	↓ 9.4%	↓ 65.2%	**2002**	49,416.9	- 958.8	↓ 1.9%	↓ 10.9%
2003	18,598.2	- 268.1	↓ 1.4%	↓ 65.7%	**2003**	46,008.4	- 3,408.5	↓ 6.9%	↓ 17.0%
2004	17,666.6	- 931.6	↓ 5.0%	↓ 67.4%	**2004**	42,499.3	- 3,509.1	↓ 7.6%	↓ 23.4%
2005	16,949.2	- 717.4	↓ 4.1%	↓ 68.8%	**2005**	40,407.5	- 2,091.8	↓ 4.9%	↓ 27.1%
2006	15,510.5	- 1,438.7	↓ 8.5%	↓ 71.4%	**2006**	37,751.9	- 2,655.6	↓ 6.6%	↓ 31.9%
2007	16,887.3	+ 1,376.8	↑ 8.9%	↓ 68.9%	**2007**	35,237.4	- 2,514.5	↓ 6.7%	↓ 36.5%
2008	15,263.3	- 1,624.0	↓ 9.6%	↓ 71.9%	**2008**	31,368.7	- 3,868.7	↓ 11.0%	↓ 43.4%
2009	9,839.4	- 5,423.9	↓ 35.5%	↓ 81.9%	**2009**	28,081.0	- 3,287.7	↓ 10.5%	↓ 49.4%
2010	10,043.6	+ 204.3	↑ 2.1%	↓ 81.5%	**2010**	24,159.1	- 3,921.9	↓ 14.0%	↓ 56.4%
2011	8,776.1	- 1,267.5	↓ 12.6%	↓ 83.8%	**2011**	22,356.3	- 1,802.7	↓ 7.5%	↓ 59.7%
2012	8,717.9	- 58.1	↓ 0.7%	↓ 83.9%	**2012**	21,412.7	- 943.6	↓ 4.2%	↓ 61.4%
2013	9,497.8	+ 779.9	↑ 8.9%	↓ 82.5%	**2013**	19,293.3	- 2,119.4	↓ 9.9%	↓ 65.2%
2014	9,262.5	- 235.4	↓ 2.5%	↓ 82.9%	**2014**	17,629.6	- 1,663.7	↓ 8.6%	↓ 68.2%
2015	9,296.8	+ 34.3	↑ 0.4%	↓ 82.9%	**2015**	16,860.7	- 768.9	↓ 4.4%	↓ 69.6%
2016	7,986.9	- 1,309.9	↓ 14.1%	↓ 85.3%	**2016**	16,356.6	- 504.1	↓ 3.0%	↓ 70.5%
2017	8,307.9	+ 321.0	↑ 4.0%	↓ 84.7%	**2017**	16,724.9	+ 368.3	↑ 2.3%	↓ 69.8%
2018	7,653.8	- 654.1	↓ 7.9%	↓ 85.9%	**2018**	16,946.4	+ 221.5	↑ 1.3%	↓ 69.4%

Source: Data Adapted from Thistlethwaite *et al.* (2020)

Table P.6 – England's total carbon dioxide emissions [$KtCO_2e$] from LULUCF between 1990 and 2018

Year	*LULUCF*			
	Emissions ($KtCO_2e$)	Change	Per cent change	
			Yearly	Overall
1990	256.5			
1995	- 418.2	- 674.7		↓ 263.0%
1998	- 1,349.5	- 931.3		↓ 626.1%
1999	- 818.9	530.5	↑ 39.3%	↓ 419.3%
2000	- 935.4	- 116.4	↓ 14.2%	↓ 464.7%
2001	- 1,234.7	- 299.4	↓ 32.0%	↓ 581.4%
2002	- 1,636.5	- 401.8	↓ 32.5%	↓ 738.0%
2003	- 1,843.0	- 206.5	↓ 12.6%	↓ 818.5%
2004	- 2,308.7	- 465.7	↓ 25.3%	↓ 1,000.1%
2005	- 2,468.6	- 159.9	↓ 6.9%	↓ 1,062.4%
2006	- 2,694.6	- 226.0	↓ 9.2%	↓ 1,150.6%
2007	- 3,000.8	- 306.2	↓ 11.4%	↓ 1,270.0%
2008	- 3,311.6	- 310.8	↓ 10.4%	↓ 1,391.1%
2009	- 3,323.2	- 11.6	↓ 0.4%	↓ 1,395.6%
2010	- 3,610.2	- 287.0	↓ 8.6%	↓ 1,507.5%
2011	- 3,840.6	- 230.4	↓ 6.4%	↓ 1,597.3%
2012	- 3,974.9	- 134.3	↓ 3.5%	↓ 1,649.7%
2013	- 4,252.9	- 278.0	↓ 7.0%	↓ 1,758.1%
2014	- 4,390.4	- 137.4	↓ 3.2%	↓ 1,811.7%
2015	- 4,570.4	- 180.1	↓ 4.1%	↓ 1,881.9%
2016	- 4,515.6	+ 54.8	↑ 1.2%	↓ 1,860.5%
2017	- 4,718.7	- 203.1	↓ 4.5%	↓ 1,939.7%
2018	- 4,916.7	- 198.0	↓ 4.2%	↓ 2,016.9%

Source: Data Adapted from Thistlethwaite *et al.* (2020)

Appendix Q – Eurobarometer Data on Consumption of News

QB1 – In which of the following news related issues are you most interested in…? (Maximum 3 Answers)

Table Q.1 – Which news related issues are civil society most interested in [April/May 2007]

	N	Politics	Sports	Scientific Research	Arts and Culture	Economy	Entertainment and Celebrities	Other	Don't Know
Austria	1,011	371 (36.7%)	457 (45.2%)	220 (21.8%)	330 (32.6%)	202 (20.0%)	540 (53.4%)	87 (8.6%)	16 (1.6%)
Belgium	1,011	323 (31.9%)	427 (42.2%)	453 (44.8%)	349 (34.5%)	274 (27.1%)	333 (32.9%)	60 (5.9%)	8 (0.8%)
Bulgaria	1,039	410 (39.5%)	333 (32.1%)	205 (19.7%)	215 (20.7%)	244 (23.5%)	446 (42.9%)	67 (6.4%)	82 (7.9%)
Cyprus	502	213 (42.4%)	182 (36.3%)	225 (44.8%)	161 (32.1%)	198 (39.4%)	170 (33.9%)	16 (3.2%)	11 (2.2%)
Czech Republic	1,043	230 (22.1%)	477 (45.7%)	141 (13.1%)	407 (39.0%)	260 (24.9%)	452 (43.3%)	16 (1.5%)	21 (2.0%)
Denmark	1,002	622 (62.1%)	391 (39.0%)	495 (49.4%)	392 (39.1%)	379 (37.8%)	353 (35.2%)	19 (1.9%)	1 (0.1%)
Estonia	1,005	457 (45.5%)	394 (39.2%)	293 (29.2%)	399 (39.7%)	444 (44.2%)	402 (40.0%)	29 (2.9%)	25 (2.5%)
Finland	1,038	408 (39.3%)	494 (47.6%)	450 (43.4%)	353 (34.0%)	476 (45.9%)	340 (32.8%)	20 (1.9%)	4 (0.4%)
France	1,013	390 (38.5%)	429 (42.3%)	470 (46.4%)	445 (43.9%)	370 (36.3%)	287 (28.3%)	24 (2.4%)	7 (0.7%)
Germany	1,513	794 (52.5%)	577 (38.1%)	521 (34.4%)	443 (29.3%)	472 (31.2%)	571 (37.7%)	45 (3.0%)	14 (0.9%)
Greece	1,000	392 (39.2%)	296 (29.6%)	511 (51.1%)	330 (33.0%)	387 (38.7%)	366 (36.6%)	6 (0.6%)	1 (0.1%)
Hungary	1,006	245 (24.4%)	370 (36.8%)	240 (23.9%)	339 (33.7%)	345 (34.3%)	457 (45.4%)	19 (1.9%)	31 (3.1%)
Ireland	1,000	290 (29.0%)	541 (54.1%)	189 (18.9%)	255 (25.5%)	296 (29.6%)	416 (41.6%)	66 (6.6%)	41 (4.1%)
Italy	1,010	220 (21.8%)	336 (33.3%)	320 (31.7%)	284 (28.1%)	176 (17.4%)	252 (25.0%)	80 (7.9%)	60 (5.9%)
Latvia	1,013	336 (33.2%)	379 (37.4%)	258 (25.5%)	412 (40.7%)	322 (31.8%)	383 (37.8%)	22 (2.2%)	22 (2.2%)
Lithuania	1,018	287 (28.2%)	355 (34.9%)	223 (21.9%)	300 (29.5%)	293 (28.8%)	407 (40.0%)	112 (11.0%)	50 (4.9%)
Luxembourg	511	205 (40.1%)	202 (39.5%)	232 (45.4%)	180 (35.2%)	162 (31.7%)	152 (29.7%)	17 (3.3%)	3 (0.6%)
Malta	500	150 (30.0%)	188 (37.6%)	139 (27.8%)	176 (35.2%)	126 (25.2%)	233 (46.6%)	17 (3.4%)	6 (1.2%)
Netherlands	1,009	539 (53.4%)	392 (38.9%)	416 (41.2%)	404 (40.0%)	386 (38.3%)	238 (23.6%)	55 (5.5%)	10 (1.0%)
Poland	1,000	275 (27.5%)	392 (39.2%)	175 (17.5%)	257 (25.7%)	307 (30.7%)	432 (43.2%)	26 (2.6%)	53 (5.3%)
Portugal	1,011	203 (20.1%)	457 (45.2%)	164 (16.2%)	272 (26.9%)	148 (14.6%)	420 (41.5%)	68 (6.7%)	51 (5.0%)
Romania	1,019	316 (31.0%)	395 (38.8%)	176 (17.3%)	218 (21.4%)	278 (27.3%)	581 (57.0%)	72 (7.1%)	43 (4.2%)
Slovakia	1,106	412 (37.3%)	490 (44.3%)	213 (19.3%)	427 (38.6%)	383 (34.6%)	551 (49.8%)	34 (3.1%)	13 (1.2%)
Slovenia	1,013	333 (32.9%)	490 (48.4%)	300 (29.6%)	237 (23.4%)	415 (41.0%)	3127 (31.3%)	80 (7.9%)	7 (0.7%)

Table Q.1 – Which news related issues are civil society most interested in [April/May 2007] (Continued)

	N	**Politics**	**Sports**	**Scientific Research**	**Arts and Culture**	**Economy**	**Entertainment and Celebrities**	**Other**	**Don't Know**
Spain	1,000	193 (19.3%)	396 (39.6%)	227 (22.7%)	393 (39.3%)	176 (17.6%)	250 (25.0%)	140 (14.0%)	33 (3.3%)
Sweden	1,005	508 (50.5%)	456 (45.4%)	558 (55.5%)	338 (33.6%)	465 (46.3%)	265 (26.4%)	15 (1.5%)	4 (0.4%)
United Kingdom	1,319	361 (27.4%)	562 (42.6%)	383 (29.0%)	361 (27.4%)	351 (26.6%)	423 (32.1%)	29 (2.2%)	64 (4.9%)
European Union	26,717	9,064 (33.9%)	10,554 (39.5%)	8,289 (31.0%)	8,533 (31.9%)	7,542 (28.2%)	9,221 (34.5%)	1,322 (4.9%)	815 (3.1%)

Note: All Percentages might not add up to 100 per cent due to rounding errors

Source: Data Adapted from Eurobarometer (2007)

Appendix R – Socio-Economic Breakdown of Surveys from this Thesis

Table R.1 – Respondent's Nation Breakdown from Questionnaire 1

Respondent's Nation	Number or Respondents	Percentage		United Kingdom Share
England	**886**	78.1%	81.6%	83.9%
Northern Ireland	**21**	1.9%	1.9%	2.8%
Scotland	**58**	5.1%	5.3%	8.2%
Wales	**76**	6.7%	7.0%	4.7%
Crown Dependencies	**45**	4.0%	4.1%	0.4%
International / Refused	**48**	4.2%		
Total	**1,134**			

Note: All Percentages might not add up to 100 per cent due to rounding errors

Source: Author

Table R.2 – Respondent's Religion Breakdown from Questionnaire 1

Respondent's Religion	Number of Respondents	Percentage		United Kingdom Population[74]
Christianity	508	44.8%	47.9%	59.3%
Islam	15	1.3%	1.4%	4.8%
Hinduism	7	0.6%	0.7%	1.5%
Sikhism	1	0.1%	0.1%	0.8%
Judaism	5	0.4%	0.5%	0.5%
Buddhism	9	0.8%	0.9%	0.4%
Atheism	453	40.0%	42.7%	25.1%
Others	63	5.6%	5.9%	0.4%
Multiple Answers Given	2	0.2%		
Refused	71	6.3%		
Total	**1,134**			

Note: All Percentages might not add up to 100 per cent due to rounding errors

Source: Author and Data Adapted from ONS (2012)

[74] - Based upon 2011 Census Data

Table R.3 – Respondent's Sexuality Breakdown from Questionnaire 1

Respondent's Sexuality	Number of Respondents	Percentage	
Heterosexual	**977**	86.2%	92.6%
Bisexual	**37**	3.3%	3.5%
Homosexual	**37**	3.3%	3.5%
Asexual	**4**	0.4%	0.4%
Refused	**79**	7.0%	
Total	**1,134**		

Note: All Percentages might not add up to 100 per cent due to rounding errors

Source: Author

Table R.4 – Respondent's Employment Breakdown from Questionnaire 1

In Employment?	Number of Respondents	Percentage	
Yes	710	62.6%	63.5%
No	408	36.0%	36.5%
Refused	16	1.4%	
Total	**1,134**		

Note: All Percentages might not add up to 100 per cent due to rounding errors

Source: Author

Table R.5 – Respondent's Ethnicity Breakdown from Questionnaire 1

Respondent's Ethnicity	Number of Respondents	Percentage	
White	1,031	90.92%	94.41%
Asian [British]	28	2.47%	2.56%
Mixed [British]	19	1.68%	1.74%
Black	12	1.06%	1.10%
Others	7	0.62%	0.64%
Arab	2	0.18%	0.18%
Refused	35	3.09%	
Total	**1,134**		

Note: All Percentages might not add up to 100 per cent due to rounding errors

Source: Author

Table R.6 – Respondent's Home Region Breakdown from Questionnaire 2

Respondent's Home Region	Number of Respondents	Percentage	
North East England	252	14.8%	15.7%
North West England	204	12.0%	12.7%
Yorkshire and the Humber	135	7.9%	8.4%
East Midlands	71	4.2%	4.4%
West Midlands	59	3.5%	3.7%
East of England	93	5.5%	5.8%
London	142	8.4%	8.8%
South East England	177	10.4%	11.0%
South West England	170	10.0%	10.6%
Wales	32	1.9%	2.0%
Scotland	133	7.8%	8.3%
Northern Ireland	65	3.8%	4.0%
Crown Dependencies	2	0.1%	0.1%
Others	73	4.3%	4.5%
Refused	92	5.4%	
Total	**1,700**	**100.0%**	

Note: All Percentages might not add up to 100 per cent due to rounding errors

Source: Author

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Reference Number: ______________

Appendix S – First Questionnaire [March to September 2017]

SECTION 1 – Climate Change

Question 1 – Which of the following do you think is the greatest threat that we currently face? *(Please circle only one)*

1. Climate Change
2. Diseases *(e.g. Ebola and Zika Virus)*
3. Economic Instability
4. Espionage *(e.g. Governmental Spying)*
5. Migration
6. Nuclear Weapons
7. Political Tensions
8. Terrorism *(e.g. Al Qaeda and IS)*

Question 2 – Which of the following do you believe is the greatest environment issue we face? *(Please circle only one)*

1. Air Pollution
2. Animal Extinction
3. Climate Change
4. Damage to the Ozone Layer
5. Deforestation of Rainforests
6. Genetic Engineering
7. Overpopulation
8. Radiation
9. Resource Depletion
10. Waste
11. Water Pollution

Question 3 – Do you believe that the world's climate is changing?

1. Yes
2. No (**Go to Question 5**)
3. Don't Know (**Go to Question 5**)

Question 4 – What do you believe is the cause of this change? *(Please circle only one)*

1. Caused by natural processes, either mainly or entirely
2. Caused by human processes, either mainly or entirely
3. Caused by a combination of human and natural processes

Question 5 – Finish the following sentences about United Kingdom and Global Temperatures. *(Delete increase/describe as appropriate)*

1. The United Kingdom temperatures have [increased/decreased] by ____^{o}C since 1915.
2. Global temperatures have [increased/decreased] by ____^{o}C since 1880.
3. The United Kingdom temperatures will [increase/decrease] by ____^{o}C by 2100.
4. Global temperatures will [increase/decrease] by ____^{o}C by 2100.

Question 6 – Finish the following sentences about global sea-level. *(Delete increase/describe as appropriate) (Please note, there are no right or wrong answers)*

1. Global sea-level has [increased/decreased] by ____ meters since 1880.
2. Global sea-level will [increased/decreased] by ____ meters by 2100.

Question 7 – Which of the following terms do you use to describe the current perceived change in the climate? *(Please circle only one)*

1. Climate Change
2. Global Cooling
3. Global Warming

Question 8 – How fearful are you of both climate change and global warming? *(Please tick only one response per row)*

	1 **Not Fearful at all**	2	3 **Neutral**	4	5 **Very Fearful**
Climate Change					
Global Warming					

Question 9 – Is climate change and global warming a good thing for the environment and humanity? *(Please tick only one response per row)*

	1 **Very Bad**	2	3 **Neutral**	4	5 **Very Good**
Climate Change					
Global Warming					

Question 10 – What do you think is the cause of both climate change and global warming? *(Please tick only one response per row)*

	Natural Processes	**Human Processes**	**Both Human and Natural**
Climate Change			
Global Warming			

Question 11 – With future climate change, how do you think the following issues are going to change within the United Kingdom? *(Please tick only one response per row)*

	Lower Occurrence	**Same Rate of Occurrence**	**Greater Occurrence**
Animal Extinctions			
Cold Waves			
Crop Losses			
Diseases			
Droughts			
Economic Losses			
Flooding			
Heat Wave			
Migration			
Insurance Premiums			
Poor Air Quality			
Rainfall			
Snowfall (+ Blizzards)			
Water Availability			
Wild Fires			
Wind Storms			

Question 12 – What do you think is the percentage of climate scientists that believe humans are causing climate change/global warming?

1. 0-20%
2. 21-40%
3. 41-60%
4. 61-80%
5. 81-100%

Question 13 – How trustworthy do you think different people and organisations are in relation in terms of communicating the truth of climate change? *(Please tick only one response per row)*

	1 Not Trustful at all	**2**	**3 Neutral**	**4**	**5 Very Trustful**
Celebrities					
Education Sector (Schools etc.)					
Environmental Groups					
Family					
Friends					
Local Government					
National Government					
Police					
Religious Leaders					
Scientists and Researchers					

SECTION 2 – Climate Change and Education

Question 14 – Were you taught at school/college/university about climate change?

1. Yes
2. No (**Go to Question 17**)
3. Don't Know (**Go to Question 17**)

Question 15 – Which level of education were you taught about climate change? *(Circle all that apply)*

1. Primary School
2. Secondary School
3. College
4. University

Question 16 – Briefly describe what you were taught about climate change.

____
____
____

Question 17 – What level of education should climate change be taught at? *(Circle all that apply)*

1. Primary School
2. Secondary School
3. College
4. University

Question 18 – Do you think that workshops and presentations should be offered freely to the public to explain the science and effects of climate change?

1. Yes
2. No
3. Don't Know

SECTION 3 – Climate Change and You

Question 19 – Have you previously been affected by an extreme weather event?

1. Yes
2. No
3. Don't Know

Question 20 – Which of the following have you been significantly impacted by in the last five years? *(Circle all that apply)*

1. Blizzard
2. Cold Wave *(Extreme Cold Temperatures)*
3. Drought
4. Extreme Wind (70+ mph)
5. Flooding
6. Heat Wave *(Extreme High Temperatures)*
7. Landslide/Mudslide
8. Tornadoes
9. Wildfires

Question 21 – Do you think experiencing these extreme weather conditions have changed your perception of climate change?

1. Yes
2. No **(Go to Question 23)**
3. Don't Know **(Go to Question 23)**

Question 22 – How has it changed your perception of climate change?

____
____
____

Question 23 – Which of the following have you undertaken in the last three years, which have reduced your contributions towards climate change? *(Circle all that apply)*

1. Driving an electric/hybrid car
2. Making fewer car journeys
3. Car share to work
4. Walk or Cycle to work
5. Public Transport
6. Buy second hand produces
7. Buy food with less packaging
8. Buy locally grown food
9. Eat less meat
10. Grow your own food
11. Install house insulation
12. Install low energy light blubs
13. Install renewable energy
14. Unplug appliance when not used
15. Switch off lights
16. Turn down heating
17. Use water sparingly
18. Reduce personal waste production
19. Recycle Waste

Question 24 – Are you a member of an environmental organisation?

1. Yes
2. No **(Go to Question 27)**

Question 25 – Which environmental organisation(s) are you a member of?

____
____

SECTION 4 – Climate Change Policy

Question 26 – Do you agree that the United Kingdom should be reducing its greenhouse gas emissions (e.g. carbon dioxide, methane etc.), which is believed to be the main cause of perceived current change in the climate? *(Please tick only one)*

1 Definitely No	2	3 Don't Know	4	5 Definitely Yes

Question 27 – In 2008, the United Kingdom passed legislation that stated greenhouse gas emissions should be cut by 80 per cent by the year 2050. How much are you in favour or opposed to this agreement? *(Please Tick only one)*

1 Strongly Oppose	2	3 Neutral	4	5 Strongly Favour

Question 28 – Currently, 57.95p per litre of petrol and diesel sold at petrol stations goes to the government in terms of Fuel Duty. In the past, it has been suggested that rises in Fuel Duty has resulted in increased efficiency of vehicles. How supportive would you be if the Government would want to increase Fuel Duty again in the next 12 months? *(Please tick only one)*

1 Not Supportive	2	3 Neutral	4	5 Supportive

Question 29 – In April 2017, the British Government is changing the Road Tax on new vehicles, which is aimed at promoting the sale of low emitting vehicles. It is estimated that 70 per cent of new cars will be subject to increases in Road Tax. For example, Road Tax for a Land Rover Discovery will see its increase from £1,100 to £2,000 in the first year. How supportive or opposed are you to this change in Road Tax? *(Please tick only one)*

1 Not Supportive	2	3 Neutral	4	5 Supportive

Question 30 – Which of the following electricity supply do you think the UK should be using? *(Circle all that apply)*

1. Coal
2. Fracking
3. Gas
4. Hydro
5. Nuclear
6. Oil
7. Solar
8. Tidal
9. Wind

Question 31 – On a scale of 1 to 5, do you think the British Government is doing enough about reducing the effects of, and adapting to climate change? *(Please tick only one)*

1 Not Enough	2	3 Neutral	4	5 Enough

Question 32 – What do you think the Government should be doing in the future to combat against the effects of climate change?

____

SECTION 5 – Media and Climate Change

Question 33 – How often do you watch, read and listen to the news each week? *(Please Tick only one response per row)*

	I Don't	1 or 2 Days a Week	3 or 4 Days a Week	5 or 6 Days a Week	Daily
Television News					
Radio News					
Newspapers					

Question 34 – Which of the following television news do you usually watch? *(Circle all that apply)*

1. Al Jazeera
2. BBC News
3. Channel 4 News
4. Channel 5 News
5. ITV News
6. RT (Russia Today)
7. Sky News
8. Others: ______________

Question 35 – Which radio news do you most frequently listen to?

____

Question 36 – Which national newspaper *(including online)* do you read? *(Circle all that apply)*

1. City A.M.
2. Daily Express
3. Daily Mail
4. Daily Mirror
5. Daily Record
6. Daily Star
7. Financial Times
8. i
9. Metro
10. Morning Star
11. The Daily Telegraph
12. The Guardian
13. The Herald
14. The Independent
15. The Irish News
16. The National
17. The Scotsman
18. The Sun
19. The Times
20. Western Mail

Question 37 – If you were an editor of a major newspaper, what would be your main headline to describe climate change?

____

____

Question 38 – Do you use social media?

1. Yes
2. No ***(Go to Question 40)***

Question 39 – Which of the following social media sites do you use? *(Circle all that apply)*

1. Facebook
2. Google+
3. Instagram
4. LinkedIn
5. Reddit
6. Tumblr
7. Twitter
8. YouTube
9. Other Blogs/Forum Sites
10. Other Video Sites

Question 40 – Do you gather information about climate change from social media sites?

1. Yes
2. No
3. Don't Know

Question 41 – In the past week, have you heard, seen or read any news about climate change?

1. Yes
2. No
3. Don't Know

Question 42 – Do you think that news about effects of climate change is exaggerated?

1. Yes
2. No

Question 43 – Which of the following statements do you believe is true about climate change and the media? *(Please circle only one)*

1. The media should be reporting less about human caused climate change
2. The media are reporting the right amount about human caused climate change
3. The media should be reporting more about human caused climate change

SECTION 6 – Demographic Data

Question 44 – What age group are you?

1. 18-24
2. 25-34
3. 35-44
4. 45-54
5. 55-64
6. 65+

Question 45 – Are you?

1. Male
2. Female
3. Other: _________

Question 46 – What is your hometown and/or county? *[Please be specific i.e. North Yorkshire instead of Yorkshire]*

Hometown:_________________________________ County:__________________________________

Question 47 – Which of the following ethnic heritage best describes you? *[options based on the 2011 census]*

1. White
   a. British
   b. Irish
   c. Other White
2. Mixed Race
   a. White and Black Caribbean
   b. White and Black African
   c. White and Asian
   d. Others Mixed Races
3. Arab
4. Asian or Asian British
   a. Indian
   b. Pakistani
   c. Bangladeshi
   d. Chinese
   e. Others: _______________
5. Black or Black British
   a. Caribbean
   b. African
   c. Others: _______________
6. Others: _____________

Reference Number: ______________

Question 48 – Which Religion do you follow?

1. Christianity
2. Islam
3. Hinduism
4. Sikhism
5. Judaism
6. Buddhism
7. None *(Atheism)*
8. Other Religion: ________________

Question 49 – Which of the following sexuality best describes you?

1. Heterosexual *(e.g. Straight)*
2. Bisexual
3. Homosexual *(e.g. Gay or Lesbian)*
4. Asexual

Question 50 – Which is the **highest** academic education you have completed and currently undertaken? If other, please be specific.

	Completed	Currently Undertaken
No Formal Qualifications		
GCSE		
A Levels/AS Levels		
First Degree (e.g. BA/BSc)		
Higher Degree (e.g. MSc/PGCE)		
Doctoral Degree (e.g. PhD)		
Other		

Question 51 – What is your political identification? *(Please circle only one)*

1. Conservative
2. Green
3. Labour
4. Liberal Democrats
5. Plaid Cymru
6. Scottish National Party *(SNP)*
7. UK Independence Party *(UKIP)*
8. Others: __________________

Question 52 – Which of the following categories best describes your household income?

1. <£10,000
2. £10,000 - £19,999
3. £20,000 - £29,999
4. £30,000 - £39,999
5. £40,000 - £49,999
6. >£49,999

Question 53 – Are you employed?

1. Yes *(including self-employed)*
2. No

If yes, please specify: ____

SECTION 7 – Further Information

Would you be willing to potentially answer further questions in the future about climate change for this study?

1. Yes
2. No

If you wish to have a copy of the findings, then please leave an email address here:

____

Reference Number: _______________

Appendix T – Second Questionnaire [May to July 2019]
SECTION 1 – Climate Change

Question 1 – Do you believe that the world's climate is changing?

1. Yes
2. No **(Go to Question 3)**
3. Don't Know **(Go to Question 3)**

Question 2 – What do you believe is the cause of this change? (*Please circle only one)*

1. Caused by natural processes, either mainly or entirely
2. Caused by human processes, either mainly or entirely
3. Caused by a combination of human and natural processes

Question 3 – Have you ever heard of "Extinction Rebellion" before today?

1. Yes
2. No **(Go to Question 7)**
3. Don't Know **(Go to Question 7)**

Question 4a – Are you overall supportive of the views of "Extinction Rebellion"?

1 **Not Supportive**	**2**	**3** **Neutral**	**4**	**5** **Supportive**

Question 4b – Please explain your choice

____
____
____

Question 5a – How supportive are you of "Extinction Rebellion" protests in central London during April 2019?

1 **Not Supportive**	**2**	**3** **Neutral**	**4**	**5** **Supportive**

Question 5b – Please explain your choice

____
____
____

Question 6a – How likely are you to join extinction rebellion on a protest in the future?

1 Not Likely	2	3 Neutral	4	5 Likely

Question 6b - Please explain your choice

____

____

____

Question 7 – Have you ever heard of "School Strike for Climate" before today?

1. Yes
2. No **(Go to Question 9)**
3. Don't Know **(Go to Question 9)**

Question 8a - How supportive are you of children striking for climate change during a school day?

1 Not Supportive	2	3 Neutral	4	5 Supportive

Question 8b – Please explain your choice

____

____

____

Question 9 – Have you got any other comments you wish to make in relation to climate change?

____

____

____

____

____

SECTION 2 - Demographic Data

Question 10 – What age group are you?

1. 18-24
2. 25-34
3. 35-44
4. 45-54
5. 55-64
6. 65+

Question 11 – Are you?

1. Male
2. Female
3. Other: __________

Question 12 – What is your hometown and/or county? *[Please be specific i.e. North Yorkshire instead of Yorkshire]*

Hometown:________________________________ County:_________________________________

Question 13 – Which of the following ethnic heritage best describes you? *[options based on the 2011 census]*

1. White
   a. British
   b. Irish
   c. Other White
2. Mixed Race
   a. White and Black Caribbean
   b. White and Black African
   c. White and Asian
   d. Other Mixed Races
3. Arab
4. Asian or Asian British
   a. Indian
   b. Pakistani
   c. Bangladeshi
   d. Chinese
   e. Others: __________
5. Black or Black British
   a. Caribbean
   b. African
   c. Others: __________
6. Others: __________

Question 14 – What is your political identification? *(Please circle only one)*

1. Brexit Party
2. Change UK
3. Conservative
4. Green
5. Labour
6. Liberal Democrats
7. Plaid Cymru
8. Scottish National Party (SNP)
9. UK Independence Party (UKIP)
10. Others: __________________

SECTION 3 – Further Information

If you wish to have a copy of the findings, then please leave an email address here:

____

Thank you again for completing this survey on climate change activism.

Appendix U – Interview Permission Form

Climate Change Perception, Engagement and Reaction Interview Release Document

You are been asked to participate in research designed to better understand the public's perception, engagement and reaction towards climate change. You were selected due the response that you gave during your questionnaire flagged some interesting results and/or within the target age group for this study. The study is based upon that there is a consensus within the scientific community that current climate change is as a result of human-related activities. However, the level of acceptance amongst the public is much lower. This lower level of perception that human caused climate change is occurring, results in fewer people both reacting and engaging with climate change and its effects. Therefore, this interview will examine key themes of why people perceive climate change the way that they do. The findings of the research will be written up in my Doctoral Thesis and other future publications.

Please contact me using the details above if:

- you have any questions or comments about the research;
- you wish to withdraw your responses from the research;
- you would like to access the information you have given to the research.

All information will be handled under the Data Protection Act: paper copies of questionnaires will be stored securely with names/identifiers kept separately from the content of the questionnaires; electronic data sheets and analysis will be stored securely on a password-protected computer. All data will be kept for future reference and be kept for a minimum of two years after the project has finished.

All respondents are guaranteed anonymity *unless otherwise agreed* – no real names of individuals, businesses, organisations or places of work, or contact addresses/details will be used in reports or dissemination of research *unless you request it*.

If you have any questions or would like additional clarification regarding this research, please contact me at your convenience at: [redacted] or by e-mail at ashley.parry@northumbria.ac.uk. By completing this interview you are furthering the development of knowledge within topic of climate anthropology.

Thank you for your participation.

Mark Ashley Parry

I give my permission to be interviewed and to have my voice recorded as a part of this research being conducted.

____________________________ ____________________

Signature Date

Appendix V – List of Data Sources Used within this Thesis

Table V.1 – List of data sources used within this thesis

Source	Years of Publication
BEIS	2012-2020 (x4)
DfT	2020
Eurobarometer	2007, 2009, 2011, 2013, 2015, 2017, 2019
Ofcom	2018, 2020
Questionnaire	2017, 2019
YouGov	2020

Source: Author

Appendix W – Sample BEIS Questionnaire

Energy Saving and Wasting

Question 2 – How much thought, if any, would you say you give to saving energy in your home?

1. A lot
2. A fair amount
3. Not very much
4. None at all
5. Don't Know

Question 4 – How often, if at all, do you personally do any of the following?

a) Leaving the lights on when you are not in the room.
b) Boil the kettle with more water than you are going to use.
c) Wash clothes at 30 degrees or lower.
d) Try to keep rooms that you are not using at a cooler temperature than those you are using.
e) Leave the heating on when you go out for a few hours.

1. Always
2. Very often
3. Quite often
4. Occasionally
5. Never
6. Don't Know
7. Not Applicable

Renewables

Question 3 – The new question is about renewable. This covers a number of different forms, including wind power, solar energy and biomass.

Do you support or oppose the use of renewable energy for providing our electricity, fuel and heat?

1. Strongly support
2. Support
3. Neither support nor oppose
4. Oppose
5. Strongly oppose
6. Don't Know

Question 12 – I'm now going to read out a number of statements about renewable energy. Please tell me how much you agree or disagree with each on. As mentioned earlier, renewable energy covers a number of different forms, including wind power, solar energy and biomass.

a) Renewable energy industries and developments provide economic benefits to the UK
b) I would be happy to have a large scale renewable energy development in my area
c) Renewable energy should provide direct benefit to the communities in which they are located.

1. Strongly agree
2. Slightly agree
3. Neither agree not disagree
4. Slightly disagree
5. Strongly disagree
6. Don't Know

Question 13 – Generally speaking, do you support or oppose the use of the following renewable energy developments:

a) On-shore wind
b) Biomass – this includes any plant or animal base material such as wood, specially grown energy crops, and other organic wastes that can be used in the process of creating energy
c) Off-shore wind
d) Wave and tidal
e) Solar

1. Strongly Support
2. Support
3. Neither support nor oppose
4. Oppose
5. Strongly Oppose
6. Don't Know

Nuclear Energy

Question 14 – I'm now going to ask you for your opinion on a number of issues in relation to nuclear energy.

Please just tell me how much you agree or disagree with the following statements. (Letters have changed)

a) Nuclear energy will help combat climate change in the UK (1)
b) Nuclear energy provides a reliable source of affordable energy in the UK
c) Nuclear energy generates economic benefits to the UK
d) Nuclear energy is a cost effective way of meeting the UK's energy needs
e) Nuclear energy provides a reliable source of energy in the UK (17)
f) Nuclear energy offers affordable energy for the UK (17)
g) Nuclear energy provides a safe source of energy in the UK (17)

1. Strongly agree
2. Slightly agree
3. Neither agree nor disagree
4. Slightly disagree
5. Strongly disagree
6. Don't Know

Question 14a – From what you know, or have heard about using nuclear energy for generating electricity in the UK, do you support or oppose its use?

1. Strongly Support
2. Support
3. Neither Support no Oppose
4. Oppose

5. Strongly Oppose
6. Don't Know/No Opinion

Carbon Capture and Storage

Question 15 – How much, if anything, do you know about carbon capture and storage?

1. Know a lot about it
2. Know a little about it
3. Aware of it but don't really know what it is
4. Never heard of it

Question 15ai – From what you know, or have heard about using carbon capture and storage in the UK, do you support or oppose its use?

1. Strongly Support
2. Support
3. Neither Support nor Oppose
4. Oppose
5. Strongly Oppose
6. Don't Know/No Opinion

Shale Gas

The next question is about shale gas. Shale gas is natural gas found in shale, a non-porous rock which does not allow the gas to escape.

Hydraulic fracturing or "fracking" is a process of pumping water at high pressure into shale to create narrow fractures which allow the gas to be released and captured.

The gas can then be used for electricity and heating.

Question 15a – Before today, how much, if anything, did you know about hydraulic fracturing for shale gas, otherwise known as 'fracking'?

1. Knew a lot about it
2. Knew a little about it
3. Aware of it but did not really know what it was
4. Never heard of it

Question 15b – From what you know, or have heard about, extracting shale gas to generate the UK's heat and electricity, do you support or oppose its use?

1. Strongly Support
2. Support
3. Neither Support nor Oppose
4. Oppose
5. Strongly Oppose
6. Don't Know/No Opinion

Question 15c – You said that you support hydraulic fracturing for shale gas, otherwise known as fracking. Why is this? (Only asked if Q15b = 1 or 2)

1. Good for local jobs and investment
2. Reduces dependence on other countries for UK's energy supply
3. Reduce dependence on other fossil fuels (coal, oil)
4. Need to use all available energy sources
5. Will have positive impact on climate change / meeting carbon reduction targets
6. May result in cheaper energy bills
7. Will have positive impact on UK economy
8. Won't affect me/my local area so no personal impact
9. Positive reports in the media
10. Community benefits
11. Shale Wealth Fund
12. No specific reason
13. Other (specify)
14. Don't Know

Question 15d – You said that you oppose hydraulic fracturing for shale gas, otherwise known as fracking. Why is this? (Only asked if Q15b = 4 or 5)

1. Loss/destruction of natural environment
2. Increased traffic/noise/disruption
3. Local house prices will fall
4. Use of chemicals in the process
5. Should focus on developing renewable energy sources
6. Should focus on developing other energy sources
7. Risk of contamination to water supply
8. Risk of earthquakes
9. Negative impact on climate change / meeting carbon reduction targets
10. Not a safe process
11. Will not be regulated effectively
12. Negative reports in the media
13. Too much risk / uncertainty to support at present
14. No Specific reason
15. Other (specify)
16. Don't Know

Question 15e – You said that you either [don't know whether your support or oppose] or [neither support nor oppose] hydraulic fracturing for shale gas, otherwise known as fracking. Why is this?

1. Don't know enough about it
2. Not interested in it
3. I can see the positives and negative
4. Haven't made up my mind yet
5. Will have no impact on me
6. There are many vocal campaigns and I don't know what to believe
7. Have never heard of it
8. Other (specify)

Electric Vehicles

Question 10 – The next question is about electric cars and vans, that is, cars and vans that are recharged by plugging them directly into an electricity supply. Which of these statements best describes your attitude towards buying an electric car or van?

1. I already own an electric car or van.
2. I am thinking about buying an electric car or van quite soon.
3. I am thinking about buying an electric car or van, but I haven't thought about when I will buy it.
4. I have thought about buying an electric car or van, but have decided not to at this stage.
5. I haven't really thought about buying an electric car or van.
6. I have never heard of electric cars or vans.
7. I don't drive / don't need a car.
8. Don't Know.

Climate Change

Question 21 – How concerned, if at all, are you about climate change, sometimes referred to as 'global warming'?

1. Very concerned
2. Fairly concerned
3. Not very concerned
4. Not at all concerned
5. Don't Know

Question 22 – Thinking about the causes of climate change, which, if any, o the following best describe your opinion?

1. Climate change is entirely caused by natural processes
2. Climate change is mainly caused by natural processes
3. Climate change is partly caused by natural processes and partly caused by human activity
4. Climate change is mainly caused by human activity
5. Climate change is entirely caused by human activity
6. I don't think there is such a thing as climate change
7. Don't know
8. No opinion

And now a few more questions about climate change, also known as global warming. By climate change we mean a long-term shift in the planet's weather patterns and rising average global temperatures.

Question 180 – Which of these describes your views about the impact of climate change in the UK? (Only asked if Question 22 = 1 or 2 or 3 or 4 or 5 or 7 or 8)

1. Climate change is already having an impact in the UK.
2. Climate change is not yet having an impact, but will do in my lifetime.
3. Climate will not have an impact in my lifetime, but will do for future generations in the UK.
4. Climate change is not happening / will never have an impact in the UK.

Question 181 – And how much, if at all, do you think climate change is currently affecting… (Only asked if Question 22 = 1 or 2 or 3 or 4 or 5 or 7 or 8)

a) Your local area
b) People in the UK as a whole
c) People in other countries

1. A great deal
2. To some extent
3. Not too much
4. Not at all
5. Don't Know

Question 182 – Thinking just about the UK, have you noticed any impacts of climate change over the past few years? If so, which ones? (Only asked if Question 22 = 1 or 2 or 3 or 4 or 5 or 7 or 8)

1. Rising sea levels / more flooding
2. Reduced food availability / impact on farming
3. Reduced water availability / droughts
4. Changes in plants or wildlife / plants or animal extinction
5. More health problems (e.g. asthma)
6. Rising temperatures / heat / hotter summers
7. More extreme events such as storms
8. Increased pollution
9. Increased wildfires
10. Increased coastal erosion
11. Other (specify)
12. None/ have not noticed any impacts
13. Don't Know

Question 183 – Which of these do you think are likely to occur in the UK in the next 15 to 20 years as a result of climate change? You can choose as many as you want. (Only asked if Question 22 = 1 or 2 or 3 or 4 or 5 or 7 or 8)

1. Rising sea levels / more flooding
2. Reduced food availability / impact on farming
3. Reduced water availability / droughts
4. Changes in plants or wildlife / plants or animal extinction
5. More health problems (e.g. asthma)
6. Rising temperatures / heat / hotter summers
7. More extreme events such as storms
8. Increased pollution
9. Increased wildfires
10. Increased coastal erosion
11. Other (specify)
12. None/ have not noticed any impacts
13. Don't Know

Question 184 – Thinking now about your everyday life, do you do any of these things?

1. Choose to walk, cycle or use public transport more instead of using a car.
2. Avoid / Eat less meat.
3. Avoid / Eat less dairy produce.
4. Avoid / minimise throwing away food.
5. Drive an electric or hybrid car.
6. Think about the energy efficiency of products.
7. Minimise the amount of energy you use at home (for example, washing at lower temperatures, switch off lights).
8. Avoid / minimise air travel.
9. None of the above
10. Don't Know

Question 185 – You mentioned that you currently do [Question 184 – Response 1 to 8]. What would you say is the main reason for this?

1. I do this mainly because I want to help limit the effects of climate change.
2. I do this mainly for other reasons (e.g. lifestyle choice, cost, convenience, health, ethical reasons)
3. A mixture of both
4. No particular reason
5. Don't Know

Question 186 – If everybody in the UK did the following, which three of these do you think would have the biggest impact on tackling climate change in the UK? (Only asked if Question 22 = 1 or 2 or 3 or 4 or 5 or 7 or 8)

1. Choose to walk, cycle or use public transport more instead of using a car.
2. Avoid / Eat less meat.
3. Avoid / Eat less dairy produce.
4. Avoid / minimise throwing away food.
5. Drive an electric or hybrid car.
6. Think about the energy efficiency of products.
7. Minimise the amount of energy you use at home (for example, washing at lower temperatures, switch off lights).
8. Avoid / minimise air travel.
9. None of the above
10. Don't Know

Question 187 – Which of these do you think should have the most responsibility for tackling the effects of climate change in the UK? (Only asked if Question 22 = 1 or 2 or 3 or 4 or 5 or 7 or 8)

1. The general public, by making changes to their lifestyle.
2. Businesses, by doing more to reduce their impact on the environment.
3. Government, by introducing more policies to reduce the level of carbon emissions.
4. Can't choose, all / more than one equal.

Question 188 – And now a few questions about trust in information sources. How much do you trust [INSERT ITEM] to provide accurate information about climate change?

a) Newspapers or newspaper websites.
b) TV news such as BBC, ITV, Sky.
c) Social media such as Facebook, Twitter.
d) TV and radio documentaries.
e) UK Government.
f) Scientists working at universities.
g) Scientific organisation such as Royal Society, Met Office.
h) Charities, Environmental or Campaign groups such as Greenpeace, Friends of the Earth.

1. Trust a great deal.
2. Trust to some extent.
3. Do not have much trust.
4. Do not trust at all.
5. Not applicable.
6. Don't Know.
7. It depends.

Question 189 – How much do you agree or disagree with the following statements?

a) It's not worth doing things to help reduce climate change if others don't do the same.
b) There is so much conflicting information about climate it is difficult to know what to believe.
c) If everybody does their bit, we can reduce the effects of climate change.
d) I have the ability to make changes in my life that could help reduce climate change.
e) The media exaggerates the impacts of climate change.

1. Agree strongly.
2. Agree slightly.
3. Neither agree nor disagree.
4. Disagree slightly.
5. Disagree strongly.
6. Don't Know.

Energy Security

Question 23 – And still thinking about the next 10-20 years, how concerned, it at all, are you about…

c) The UK not investing fast enough in alternative sources of energy.

d) The UK not developing technology to use existing sources of fossil fuels sufficiently.

1. Very concerned.
2. Fairly concerned.
3. Not very concerned.
4. Not at all concerned.
5. Don't Know.

Clean Growth

Question 80 – Now a question on a different topic… The Government has recently begun to promote the concept of 'Clean Growth'. Before today, how much, if anything, did you know about this concept?

1. Hadn't heard about this before now.
2. Hardly anything but I've heard of this.
3. A little.
4. A fair amount.
5. A lot.
6. Don't Know.

Net Zero

Question 220 – Now a question on a different topic… The Government promotes the concept of 'Net Zero'. Before today, how much, if anything, did you know about this concept?

1. Hadn't heard about this before now.
2. Hardly anything but I've heard of this.
3. A little.
4. A fair amount.
5. A lot.
6. Don't Know.

Appendix X – Fieldwork Dates and Sample Sizes for BEIS Public Attitudes Tracker Questionnaires

Table X.1 – Fieldwork Dates and Sample Sizes for the DECC/BEIS Questionnaires

Waves		Fieldwork Dates	Sample Sizes	Department
1	March 2012	21st – 25th March 2012	2,121	Department of Energy and Climate Change (DECC)
2	June 2012	27th – 1st July 2012	2,100	
3	September 2012	26th – 30th September 2012	2,118	
4	December 2012	12th – 2nd January 2013	2,107	
5	March 2013	27th – 31st March 2013	2,051	
6	June 2013	3rd – 7th July 2013	2,124	
7	September 2013	25th – 29th September 2013	2,103	
8	December 2013	11th – 15th December 2013	2,110	
9	March 2014	26th – 30th March 2014	2,040	
10	June 2014	25th – 29th June 2014	2,087	
11	September 2014	24th – 28th September 2014	2,103	
12	December 2014	10th – 8th January 2015	2,119	
13	March 2015	18th – 29th March 2015	1,981	
14	June 2015	24th – 28th June 2015	2,118	
15	September 2015	23rd – 27th September 2015	2,121	
16	December 2015	9th – 13th December 2015	2,121	
17	March 2016	23rd – 27th March 2016	2,105	
18	June 2016	29th – 3rd July 2016	2,114	
19	September 2016	28th – 3rd October 2016	2,080	Department for Business, Energy and Industrial Strategy (BEIS)
20	December 2016	14th – 18th December 2016	2,138	
21	March 2017	29th – 2nd April 2017	2,180	
22	June 2017	30th – 4th July 2017	2,097	
23	September 2017	27th – 1st October 2017	2,105	
24	December 2017	13th – 17th December 2017	2,078	
25	March 2018	28th – 6th April 2018	2,102	
26	June 2018	11th – 17th July 2018	4,268[75]	
27	September 2018	19th – 30th September 2018	4,258	
28	December 2018	5th – 16th December 2018	4,273	
29	March 2019	13th – 24th March 2019	4,224	
30	June 2019	5th – 16th June 2019	4,231	
31	September 2019	11th – 22nd September 2019	4,201	
32	December 2019	4th – 22nd December 2019	4,212	
33[76]	March 2020	11th – 17th March 2020	1,851	
34[77]	June 2020	4th – 9th June 2020	4,011	

Source: Data Adapted from BEIS (2020b)

[75] - Sample size was increased from this wave to allow greater regional analysis

[76] - Fieldwork for this wave was finished early due to the COVID-19 pandemic and associated lockdown, resulting in a smaller sample size.

[77] - Unlike the rest of the surveys, this survey was collected via Kantur Online Omnibus Survey compared to face-to-face interviews. As a consequence, the socio-economic proportions within this study are slightly different compared to the previous studies, which are demonstrated within Table X.2.

Table X.2 – The Age Breakdown for the DECC/BEIS Questionnaires

Wave	Date	16-24	25-34	35-44	45-54	55-64	65+	Total
1	March 2012	330 15.6%	381 18.0%	333 15.7%	300 14.1%	279 13.2%	498 23.5%	**2,121**
2	June 2012	273 13.0%	330 15.7%	334 15.9%	332 15.8%	279 13.3%	552 26.3%	**2,100**
3	September 2012	370 17.5%	378 17.8%	308 14.5%	287 13.6%	258 12.2%	517 24.4%	**2,118**
4	December 2012	332 15.8%	401 19.0%	327 15.5%	334 15.9%	252 12.0%	461 21.9%	**2,107**
5	March 2013	283 13.8%	332 16.2%	312 15.2%	361 17.6%	268 13.1%	495 24.1%	**2,051**
6	June 2013	293 13.8%	346 16.3%	322 15.2%	304 14.3%	310 14.6%	549 25.8%	**2,124**
7	September 2013	360 17.1%	372 17.7%	312 14.8%	313 14.9%	300 14.3%	446 21.2%	**2,103**
8	December 2013	284 13.5%	338 16.0%	289 13.7%	306 14.5%	323 15.3%	570 27.0%	**2,110**
9	March 2014	319 15.6%	371 18.2%	302 14.8%	288 14.1%	280 13.7%	480 23.5%	**2,040**
10	June 2014	305 14.6%	370 17.7%	303 14.5%	294 14.1%	268 12.8%	547 26.2%	**2,087**
11	September 2014	305 14.6%	370 17.7%	303 14.5%	294 14.1%	268 12.8%	547 26.2%	**2,087**
12	December 2014	282 13.3%	414 19.5%	295 13.9%	288 13.6%	307 14.5%	533 25.2%	**2,119**
13	March 2015	264 13.3%	327 16.5%	302 15.2%	288 16.3%	270 13.6%	495 25.0%	**1,981**
14	June 2015	280 13.2%	348 16.4%	309 14.6%	303 14.3%	290 13.7%	588 27.8%	**2,118**
15	September 2015	299 14.1%	322 15.2%	293 13.8%	309 14.6%	302 14.2%	596 28.1%	**2,121**
16	December 2015	335 15.8%	344 16.2%	292 13.8%	265 12.5%	286 13.5%	599 28.2%	**2,121**
17	March 2016	257 12.2%	357 17.0%	300 14.3%	332 15.8%	277 13.2%	582 27.6%	**2,105**
18	June 2016	228 10.8%	337 15.9%	301 14.2%	287 13.6%	292 13.8%	669 31.6%	**2,114**
19	September 2016	274 13.2%	340 16.3%	271 13.0%	277 13.3%	271 13.0%	647 31.1%	**2,080**
20	December 2016	294 13.8%	374 17.5%	332 15.5%	287 13.4%	273 12.8%	578 27.0%	**2,138**
21	March 2017	262 12.0%	329 15.1%	264 12.1%	293 13.4%	337 15.5%	695 31.9%	**2,180**
22	June 2017	236 11.3%	326 15.5%	295 14.1%	283 13.5%	284 13.5%	673 32.1%	**2,097**
23	September 2017	246 11.7%	310 14.7%	315 15.0%	314 14.9%	284 13.5%	636 30.2%	**2,105**
24	December 2017	254 12.2%	371 17.9%	310 14.9%	286 13.8%	292 14.1%	565 27.2%	**2,078**

Table X.2 – The Age Breakdown for the DECC/BEIS Questionnaires (Continued)

Wave	Date	16-24	25-34	35-44	45-54	55-64	65+	Total
25	March 2018	275 13.1%	350 16.7%	281 13.4%	302 14.4%	268 12.7%	626 29.8%	**2,102**
26	June 2018	466 10.9%	650 15.2%	551 12.9%	584 13.7%	557 13.1%	1,460 34.2%	**4,268**
27	September 2018	500 11.7%	683 16.0%	580 13.6%	596 14.0%	605 14.2%	1,294 30.4%	**4,258**
28	December 2018	578 13.5%	668 15.6%	577 13.5%	573 13.4%	608 14.2%	1,269 29.7%	**4,273**
29	March 2019	475 11.2%	649 15.4%	575 13.6%	527 12.5%	611 14.5%	1,387 32.8%	**4,224**
30	June 2019	504 11.9%	683 16.1%	569 13.4%	544 12.9%	588 13.9%	1,343 31.7%	**4,231**
31	September 2019	529 12.6%	589 14.0%	583 13.9%	561 13.4%	589 14.0%	1,350 32.1%	**4,201**
32	December 2019	509 12.1%	713 16.9%	568 13.5%	544 12.9%	592 14.1%	1,286 30.5%	**4,212**
33	March 2020	257 13.9%	291 15.7%	250 13.5%	248 13.4%	269 14.5%	536 29.0%	**1,851**
34	June 2020	572 14.3%	703 17.5%	653 16.3%	706 17.6%	628 15.7%	749 18.7%	**4,011**

Note: All Percentages might not add up to 100 per cent due to rounding errors

Source: Data Adapted from BEIS (2012a); BEIS (2012b); BEIS (2012c); BEIS (2013a); BEIS (2013b); BEIS (2013c); BEIS (2013d) ; BEIS (2014a); BEIS (2014b); BEIS (2014c); BEIS (2014d) ; BEIS (2015a); BEIS (2015b); BEIS (2015c); BEIS (2015d) ; BEIS (2016a); BEIS (2016b); BEIS (2016c); BEIS (2016d) ; BEIS (2017a); BEIS (2017b); BEIS (2017c); BEIS (2017d) ; BEIS (2018a); BEIS (2018b); BEIS (2018c); BEIS (2018d) ; BEIS (2019a); BEIS (2019b); BEIS (2019c); BEIS (2019d) ; BEIS (2020a); BEIS (2020b); BEIS (2020c)

Table X.3 – The Gender Breakdown for the DECC/BEIS Questionnaires

Wave	Date	Male	Female	Total
1	March 2012	959 45.2%	1,162 54.8%	**2,121**
2	June 2012	978 46.6%	1,122 53.4%	**2,100**
3	September 2012	994 46.9%	1,124 53.1%	**2,118**
4	December 2012	990 47.0%	1,117 53.0%	**2,107**
5	March 2013	923 45.0%	1,128 55.0%	**2,051**
6	June 2013	961 45.2%	1,163 54.8%	**2,124**
7	September 2013	1,024 48.7%	1,079 51.3%	**2,103**
8	December 2013	1,027 48.7%	1,083 51.3%	**2,110**
9	March 2014	948 46.5%	1,092 53.5%	**2,040**
10	June 2014	955 45.8%	1,132 54.2%	**2,087**
11	September 2014	955 45.8%	1,132 54.2%	**2,087**
12	December 2014	1,017 48.0%	1,102 52.0%	**2,119**
13	March 2015	958 48.8%	1,023 51.6%	**1,981**
14	June 2015	1,031 48.7%	1,087 51.3%	**2,118**
15	September 2015	1,024 48.3%	1,097 51.7%	**2,121**
16	December 2015	1,036 48.8%	1,085 51.2%	**2,121**
17	March 2016	1,026 48.7%	1,079 51.3%	**2,105**
18	June 2016	1,047 49.5%	1,067 50.5%	**2,114**
19	September 2016	1,004 48.3%	1,076 51.7%	**2,080**
20	December 2016	1,011 47.3%	1,127 52.7%	**2,138**
21	March 2017	1,090 50.0%	1,090 50.0%	**2,180**
22	June 2017	1,028 49.0%	1,069 51.0%	**2,097**
23	September 2017	1,046 49.7%	1,059 50.3%	**2,105**
24	December 2017	1,000 48.1%	1,078 51.9%	**2,078**

Table X.3 – The Gender Breakdown for the DECC/BEIS Questionnaires (Continued)

Wave	Date	Male	Female	Total
25	March 2018	995 47.3%	1,107 52.7%	**2,102**
26	June 2018	2,019 47.3%	2,249 52.7%	**4,268**
27	September 2018	2,064 48.5%	2,194 51.5%	**4,258**
28	December 2018	2,092 49.0%	2,181 51.0%	**4,273**
29	March 2019	2,038 48.2%	2,186 51.8%	**4,224**
30	June 2019	2,035 48.1%	2,196 51.9%	**4,231**
31	September 2019	2,023 48.2%	2,178 51.8%	**4,201**
32	December 2019	2,096 49.8%	2,116 50.2%	**4,212**
33	March 2020	885 47.8%	966 52.2%	**1,851**
34	June 2020	1,968 49.1%	2,043 50.9%	**4,011**

Note: All Percentages might not add up to 100 per cent due to rounding errors

Source: Data Adapted from BEIS (2012a); BEIS (2012b); BEIS (2012c); BEIS (2013a); BEIS (2013b); BEIS (2013c); BEIS (2013d) ; BEIS (2014a); BEIS (2014b); BEIS (2014c); BEIS (2014d) ; BEIS (2015a); BEIS (2015b); BEIS (2015c); BEIS (2015d) ; BEIS (2016a); BEIS (2016b); BEIS (2016c); BEIS (2016d) ; BEIS (2017a); BEIS (2017b); BEIS (2017c); BEIS (2017d) ; BEIS (2018a); BEIS (2018b); BEIS (2018c); BEIS (2018d) ; BEIS (2019a); BEIS (2019b); BEIS (2019c); BEIS (2019d) ; BEIS (2020a); BEIS (2020b); BEIS (2020c)

Table X.4 – The Social Grade Breakdown for the DECC/BEIS Questionnaires

Wave	Date	AB	C1	C2	DE	Refused	Total
1	March 2012	341 16.1%	541 25.5%	428 20.2%	811 38.2%	0 0.0%	**2,121**
2	June 2012	368 17.5%	521 24.8%	438 20.9%	773 36.8%	0 0.0%	**2,100**
3	September 2012	346 16.3%	554 26.2%	401 18.9%	817 38.6%	0 0.0%	**2,118**
4	December 2012	349 16.6%	538 25.5%	414 19.6%	806 38.3%	0 0.0%	**2,107**
5	March 2013	379 18.5%	474 23.1%	424 20.7%	774 37.7%	0 0.0%	**2,051**
6	June 2013	371 17.5%	529 24.9%	452 21.3%	772 36.3%	0 0.0%	**2,124**
7	September 2013	374 17.8%	585 27.8%	406 19.3%	738 35.1%	0 0.0%	**2,103**
8	December 2013	351 16.6%	552 26.2%	435 20.6%	772 36.6%	0 0.0%	**2,110**
9	March 2014	353 17.3%	528 25.9%	428 21.0%	731 35.8%	0 0.0%	**2,040**
10	June 2014	359 17.2%	493 23.6%	410 19.6%	825 39.5%	0 0.0%	**2,087**
11	September 2014	359 17.1%	493 23.4%	410 19.5%	825 39.2%	16 0.8%	**2,087**
12	December 2014	327 15.4%	502 23.7%	447 21.1%	843 39.8%	0 0.0%	**2,119**
13	March 2015	350 17.7%	494 24.9%	364 18.4%	773 39.0%	0 0.0%	**1,981**
14	June 2015	359 16.9%	520 24.6%	416 19.6%	823 38.9%	0 0.0%	**2,118**
15	September 2015	357 16.8%	650 35.5%	422 19.9%	802 37.8%	0 0.0%	**2,121**
16	December 2015	358 16.9%	624 29.4%	428 20.2%	711 33.5%	0 0.0%	**2,121**
17	March 2016	362 17.2%	596 28.3%	406 19.3%	741 35.2%	0 0.0%	**2,105**
18	June 2016	395 18.7%	541 25.6%	426 20.2%	752 35.6%	0 0.0%	**2,114**
19	September 2016	358 17.2%	552 26.5%	440 21.2%	730 35.1%	0 0.0%	**2,080**
20	December 2016	341 15.9%	604 28.3%	480 22.5%	713 33.3%	0 0.0%	**2,138**
21	March 2017	407 18.7%	548 25.1%	432 19.8%	793 36.4%	0 0.0%	**2,180**
22	June 2017	383 18.3%	545 26.0%	419 20.0%	750 35.8%	0 0.0%	**2,097**
23	September 2017	422 20.0%	569 27.0%	418 19.9%	696 33.1%	0 0.0%	**2,105**
24	December 2017	366 17.6%	507 24.4%	428 20.6%	777 37.4%	0 0.0%	**2,078**

Table X.4 – The Social Grade Breakdown for the DECC/BEIS Questionnaires (Continued)

Wave	Date	AB	C1	C2	DE	Refused	Total
25	March 2018	366 17.4%	513 24.4%	421 20.0%	802 38.2%	0 0.0%	**2,102**
26	June 2018	786 18.4%	1,086 25.4%	886 20.8%	1,510 35.4%	0 0.0%	**4,268**
27	September 2018	654 15.4%	1,064 25.0%	943 22.1%	1,597 37.5%	0 0.0%	**4,258**
28	December 2018	729 17.1%	1,037 24.3%	912 21.3%	1,595 37.3%	0 0.0%	**4,273**
29	March 2019	761 18.0%	1,089 25.8%	856 20.3%	1,518 35.9%	0 0.0%	**4,224**
30	June 2019	785 18.6%	1,090 25.8%	875 20.7%	1,481 35.0%	0 0.0%	**4,231**
31	September 2019	736 17.5%	1,055 25.1%	886 21.1%	1,524 36.3%	0 0.0%	**4,201**
32	December 2019	806 19.1%	1,068 25.4	860 20.4%	1,478 35.1%	0 0.0%	**4,212**
33	March 2020	352 19.0%	545 29.4%	385 20.8%	569 30.7%	0 0.0%	**1,851**
34	June 2020	1,259 31.4%	1,212 30.2%	652 16.3%	888 22.1%	0 0.0%	**4,011**

Note: All Percentages might not add up to 100 per cent due to rounding errors

Source: Data Adapted from BEIS (2012a); BEIS (2012b); BEIS (2012c); BEIS (2013a); BEIS (2013b); BEIS (2013c); BEIS (2013d) ; BEIS (2014a); BEIS (2014b); BEIS (2014c); BEIS (2014d) ; BEIS (2015a); BEIS (2015b); BEIS (2015c); BEIS (2015d) ; BEIS (2016a); BEIS (2016b); BEIS (2016c); BEIS (2016d) ; BEIS (2017a); BEIS (2017b); BEIS (2017c); BEIS (2017d) ; BEIS (2018a); BEIS (2018b); BEIS (2018c); BEIS (2018d) ; BEIS (2019a); BEIS (2019b); BEIS (2019c); BEIS (2019d) ; BEIS (2020a); BEIS (2020b); BEIS (2020c)

Appendix Y – Results from the BEIS Questionnaires

Question 22 – Thinking about the causes of climate change, which, if any, of the following best describe your opinion?

Table Y.1 – Overall Perception of the Cause of the Current Change in the Climate between March 2013 and March 2020

	Climate change is entirely caused by natural processes	Climate change is mainly caused by natural processes	***NET NATURAL PROCESSES***	Climate change is partly caused by natural processes and partly caused by human activity	Climate change is mainly caused by human activity	Climate change is entirely caused by human activity	***NET HUMAN ACTIVITY***	I don't think there is such a thing as climate change	Don't Know	No opinion	Total
March 2013	105	152	**257**	**854**	559	215	**774**	84	54	28	**2,051**
	5.1%	7.4%	**12.5%**	**41.6%**	27.3%	10.5%	**37.7%**	4.1%	2.6%	1.4%	
March 2014	116	161	**277**	**905**	513	203	**716**	74	52	16	**2,040**
	5.7%	7.9%	**13.6%**	**44.4%**	25.1%	10.0%	**35.1%**	3.6%	2.5%	0.8%	
March 2015	78	174	**252**	**823**	533	225	**758**	65	57	26	**1,981**
	3.9%	8.8%	**12.7%**	**41.5%**	26.9%	11.4%	**38.3%**	3.3%	2.9%	1.3%	
March 2016	79	144	**223**	**875**	622	253	**875**	81	36	15	**2,105**
	3.8%	6.8%	**10.6%**	**41.6%**	29.5%	12.0%	**41.6%**	3.8%	1.7%	0.7%	
March 2017	83	142	**225**	**943**	594	290	**884**	84	26	18	**2,180**
	3.8%	6.5%	**10.3%**	**43.3%**	27.2%	13.3%	**40.6%**	3.9%	1.2%	0.8%	
March 2018	81	155	**236**	**813**	633	281	**914**	70	48	21	**2,102**
	3.9%	7.4%	**11.2%**	**38.7%**	30.1%	13.4%	**43.5%**	3.3%	2.3%	1.0%	
March 2019	115	210	**325**	**1747**	1290	620	**1910**	95	90	57	**4,224**
	2.7%	5.0%	**7.7%**	**41.4%**	30.5%	14.7%	**45.2%**	2.2%	2.1%	1.3%	
March 2020	49	108	**157**	**703**	569	306	**875**	39	52	25	**1,851**
	2.6%	5.8%	**8.5%**	**38.0%**	30.7%	16.5%	**47.3%**	2.1%	2.8%	1.4%	

Data Adapted from BEIS (2013b); BEIS (2014b); BEIS (2015b); BEIS (2016b); BEIS (2017b); BEIS (2018b); BEIS (2019b); BEIS (2020b)

Table Y.2 – 16-24 Year Old's Perception of the Cause of the Current Change in the Climate between March 2013 and March 2020

	Climate change is entirely caused by natural processes	Climate change is mainly caused by natural processes	*NET NATURAL PROCESSES*	Climate change is partly caused by natural processes and partly caused by human activity	Climate change is mainly caused by human activity	Climate change is entirely caused by human activity	*NET HUMAN ACTIVITY*	I don't think there is such a thing as climate change	Don't Know	No opinion	Total
March 2013	10	17	27	120	89	25	114	10	7	5	**283**
	3.5%	6.0%	9.5%	42.4%	31.4%	8.8%	40.3%	3.5%	2.5%	1.8%	
March 2014	15	19	34	122	98	43	141	9	8	5	**319**
	4.7%	6.0%	10.7%	38.2%	30.7%	13.5%	44.2%	2.8%	2.5%	1.6%	
March 2015	5	17	22	84	93	42	135	9	11	3	**264**
	1.9%	6.4%	8.3%	31.8%	35.2%	15.9%	51.1%	3.4%	4.2%	1.1%	
March 2016	8	14	22	84	99	34	133	9	8	1	**257**
	3.1%	5.4%	8.6%	32.7%	38.5%	13.2%	51.8%	3.5%	3.1%	0.4%	
March 2017	1	12	13	101	95	33	128	10	4	6	**262**
	0.4%	4.6%	5.0%	38.5%	36.3%	12.6%	48.9%	3.8%	1.5%	2.3%	
March 2018	9	18	27	92	108	31	139	3	8	6	**275**
	3.3%	6.5%	9.8%	33.5%	39.3%	11.3%	50.5%	1.1%	2.9%	2.2%	
March 2019	7	14	21	142	191	91	282	9	12	9	**475**
	1.5%	2.9%	4.4%	29.9%	40.2%	19.2%	59.4%	1.9%	2.5%	1.9%	
March 2020	5	18	23	64	101	54	155	3	11	1	**257**
	1.9%	7.0%	8.9%	24.9%	39.3%	21.0%	60.3%	1.2%	4.3%	0.4%	

Data Adapted from BEIS (2013b); BEIS (2014b); BEIS (2015b); BEIS (2016b); BEIS (2017b); BEIS (2018b); BEIS (2019b); BEIS (2020b)

Table Y.3 – 25-34 Year Old's Perception of the Cause of the Current Change in the Climate between March 2013 and March 2020

	Climate change is entirely caused by natural processes	Climate change is mainly caused by natural processes	*NET NATURAL PROCESSES*	Climate change is partly caused by natural processes and partly caused by human activity	Climate change is mainly caused by human activity	Climate change is entirely caused by human activity	*NET HUMAN ACTIVITY*	I don't think there is such a thing as climate change	Don't Know	No opinion	Total
March 2013	17	23	40	132	100	39	139	12	4	5	**332**
	5.1%	6.9%	12.0%	39.8%	30.1%	11.7%	41.9%	3.6%	1.2%	1.5%	
March 2014	14	24	38	154	113	38	151	14	9	5	**371**
	3.8%	6.5%	10.2%	41.5%	30.5%	10.2%	40.7%	3.8%	2.4%	1.3%	
March 2015	9	31	40	141	86	37	123	8	10	5	**327**
	2.8%	9.5%	12.2%	43.1%	26.3%	11.3%	37.6%	2.4%	3.1%	1.5%	
March 2016	6	22	28	142	109	53	162	13	7	5	**357**
	1.7%	6.2%	7.8%	39.8%	30.5%	14.8%	45.4%	3.6%	2.0%	1.4%	
March 2017	6	20	26	138	99	42	141	17	2	5	**329**
	1.8%	6.1%	7.9%	41.9%	30.1%	12.8%	42.9%	5.2%	0.6%	1.5%	
March 2018	11	20	31	121	132	40	172	13	9	4	**350**
	3.1%	5.7%	8.9%	34.6%	37.7%	11.4%	49.1%	3.7%	2.6%	1.1%	
March 2019	15	32	47	230	216	103	319	16	21	16	**649**
	2.3%	4.9%	7.2%	35.4%	33.3%	15.9%	49.2%	2.5%	3.2%	2.5%	
March 2020	3	15	18	105	105	47	152	2	9	5	**291**
	1.0%	5.2%	6.2%	36.1%	36.1%	16.2%	52.2%	0.7%	3.1%	1.7%	

Data Adapted from BEIS (2013b); BEIS (2014b); BEIS (2015b); BEIS (2016b); BEIS (2017b); BEIS (2018b); BEIS (2019b); BEIS (2020b)

Table Y.4 – 35-44 Year Old's Perception of the Cause of the Current Change in the Climate between March 2013 and March 2020

	Climate change is entirely caused by natural processes	Climate change is mainly caused by natural processes	*NET NATURAL PROCESSES*	Climate change is partly caused by natural processes and partly caused by human activity	Climate change is mainly caused by human activity	Climate change is entirely caused by human activity	*NET HUMAN ACTIVITY*	I don't think there is such a thing as climate change	Don't Know	No opinion	Total
March 2013	10	14	24	132	97	38	135	6	11	4	**312**
	3.2%	4.5%	7.7%	42.3%	31.1%	12.2%	43.3%	1.9%	3.5%	1.3%	
March 2014	16	19	35	153	75	24	99	7	8	0	**302**
	5.3%	6.3%	11.6%	50.7%	24.8%	7.9%	32.8%	2.3%	2.6%	0.0%	
March 2015	9	22	31	133	88	34	122	2	10	4	**302**
	3.0%	7.3%	10.3%	44.0%	29.1%	11.3%	40.4%	0.7%	3.3%	1.3%	
March 2016	10	18	28	123	101	31	132	11	3	3	**300**
	3.3%	6.0%	9.3%	41.0%	33.7%	10.3%	44.0%	3.7%	1.0%	1.0%	
March 2017	8	19	27	106	76	40	116	9	4	2	**264**
	3.0%	7.2%	10.2%	40.2%	28.8%	15.2%	43.9%	3.4%	1.5%	0.8%	
March 2018	4	23	27	109	84	40	124	12	4	5	**281**
	1.4%	8.2%	9.6%	38.8%	29.9%	14.2%	44.1%	4.3%	1.4%	1.8%	
March 2019	14	24	38	224	182	96	278	16	11	8	**575**
	2.4%	4.2%	6.6%	39.0%	31.7%	16.7%	48.3%	2.8%	1.9%	1.4%	
March 2020	6	14	20	93	80	34	114	11	8	4	**250**
	2.4%	5.6%	8.0%	37.2%	32.0%	13.6%	45.6%	4.4%	3.2%	1.6%	

Data Adapted from BEIS (2013b); BEIS (2014b); BEIS (2015b); BEIS (2016b); BEIS (2017b); BEIS (2018b); BEIS (2019b); BEIS (2020b)

Table Y.5 – 45-54 Year Old's Perception of the Cause of the Current Change in the Climate between March 2013 and March 2020

	Climate change is entirely caused by natural processes	Climate change is mainly caused by natural processes	*NET NATURAL PROCESSES*	Climate change is partly caused by natural processes and partly caused by human activity	Climate change is mainly caused by human activity	Climate change is entirely caused by human activity	*NET HUMAN ACTIVITY*	I don't think there is such a thing as climate change	Don't Know	No opinion	Total
March 2013	20	23	43	168	96	33	129	13	5	3	**361**
	5.5%	6.4%	11.9%	46.5%	26.6%	9.1%	35.7%	3.6%	1.4%	0.8%	
March 2014	13	13	26	137	80	34	114	7	3	1	**288**
	4.5%	4.5%	9.0%	47.6%	27.8%	11.8%	39.6%	2.4%	1.0%	0.3%	
March 2015	10	30	40	124	100	42	142	8	8	1	**323**
	3.1%	9.3%	12.4%	38.4%	31.0%	13.0%	44.0%	2.5%	2.5%	0.3%	
March 2016	10	17	27	156	97	34	131	12	5	1	**332**
	3.0%	5.1%	8.1%	47.0%	29.2%	10.2%	39.5%	3.6%	1.5%	0.3%	
March 2017	14	15	29	134	83	36	119	7	4	0	**293**
	4.8%	5.1%	9.9%	45.7%	28.3%	12.3%	40.6%	2.4%	1.4%	0.0%	
March 2018	9	27	36	123	88	47	135	2	5	1	**302**
	3.0%	8.9%	11.9%	40.7%	29.1%	15.6%	44.7%	0.7%	1.7%	0.3%	
March 2019	15	17	32	233	163	74	237	10	6	9	**527**
	2.8%	3.2%	6.1%	44.2%	30.9%	14.0%	45.0%	1.9%	1.1%	1.7%	
March 2020	11	11	22	99	66	47	113	4	4	6	**248**
	4.4%	4.4%	8.9%	39.9%	26.6%	19.0%	45.6%	1.6%	1.6%	2.4%	

Data Adapted from BEIS (2013b); BEIS (2014b); BEIS (2015b); BEIS (2016b); BEIS (2017b); BEIS (2018b); BEIS (2019b); BEIS (2020b)

Table Y.6 – 55-64 Year Old's Perception of the Cause of the Current Change in the Climate between March 2013 and March 2020

	Climate change is entirely caused by natural processes	Climate change is mainly caused by natural processes	*NET NATURAL PROCESSES*	Climate change is partly caused by natural processes and partly caused by human activity	Climate change is mainly caused by human activity	Climate change is entirely caused by human activity	*NET HUMAN ACTIVITY*	I don't think there is such a thing as climate change	Don't Know	No opinion	Total
March 2013	11	24	35	115	73	32	105	8	5	0	**268**
	4.1%	9.0%	13.1%	42.9%	27.2%	11.9%	39.2%	3.0%	1.9%	0.0%	
March 2014	20	21	41	125	68	27	95	8	10	1	**280**
	7.1%	7.5%	14.6%	44.6%	24.3%	9.6%	33.9%	2.9%	3.6%	0.4%	
March 2015	14	26	40	127	64	28	92	7	2	2	**270**
	5.2%	9.6%	14.8%	47.0%	23.7%	10.4%	34.1%	2.6%	0.7%	0.7%	
March 2016	11	16	27	137	71	35	106	5	1	1	**277**
	4.0%	5.8%	9.7%	49.5%	25.6%	12.6%	38.3%	1.8%	0.4%	0.4%	
March 2017	20	21	41	158	74	51	125	9	3	1	**337**
	5.9%	6.2%	12.2%	46.9%	22.0%	15.1%	37.1%	2.7%	0.9%	0.3%	
March 2018	14	19	33	102	76	39	115	14	2	2	**268**
	5.2%	7.1%	12.3%	38.1%	28.4%	14.6%	42.9%	5.2%	0.7%	0.7%	
March 2019	15	27	42	276	172	98	270	10	11	2	**611**
	2.5%	4.4%	6.9%	45.2%	28.2%	16.0%	44.2%	1.6%	1.8%	0.3%	
March 2020	10	12	22	119	72	42	114	4	7	3	**269**
	3.7%	4.5%	8.2%	44.2%	26.8%	15.6%	42.4%	1.5%	2.6%	1.1%	

Data Adapted from BEIS (2013b); BEIS (2014b); BEIS (2015b); BEIS (2016b); BEIS (2017b); BEIS (2018b); BEIS (2019b); BEIS (2020b)

Table Y.7 – 65+ Year Old's Perception of the Cause of the Current Change in the Climate between March 2013 and March 2020

	Climate change is entirely caused by natural processes	Climate change is mainly caused by natural processes	*NET NATURAL PROCESSES*	Climate change is partly caused by natural processes and partly caused by human activity	Climate change is mainly caused by human activity	Climate change is entirely caused by human activity	*NET HUMAN ACTIVITY*	I don't think there is such a thing as climate change	Don't Know	No opinion	Total
March 2013	37	51	88	187	104	48	152	35	22	11	**495**
	7.5%	10.3%	17.8%	37.8%	21.0%	9.7%	30.7%	7.1%	4.4%	2.2%	
March 2014	38	65	103	214	79	37	116	29	14	4	**480**
	7.9%	13.5%	21.5%	44.6%	16.5%	7.7%	24.2%	6.0%	2.9%	0.8%	
March 2015	31	48	79	214	102	42	144	31	16	11	**495**
	6.3%	9.7%	16.0%	43.2%	20.6%	8.5%	29.1%	6.3%	3.2%	2.2%	
March 2016	34	57	91	233	145	66	211	31	12	4	**582**
	5.8%	9.8%	15.6%	40.0%	24.9%	11.3%	36.3%	5.3%	2.1%	0.7%	
March 2017	34	55	89	306	167	88	255	32	9	4	**695**
	4.9%	7.9%	12.8%	44.0%	24.0%	12.7%	36.7%	4.6%	1.3%	0.6%	
March 2018	34	48	82	266	145	84	229	26	20	3	**626**
	5.4%	7.7%	13.1%	42.5%	23.2%	13.4%	36.6%	4.2%	3.2%	0.5%	
March 2019	49	96	145	642	366	158	524	34	29	13	**1,387**
	3.5%	6.9%	10.5%	46.3%	26.4%	11.4%	37.8%	2.5%	2.1%	0.9%	
March 2020	14	38	52	223	145	82	227	15	13	6	**536**
	2.6%	7.1%	9.7%	41.6%	27.1%	15.3%	42.4%	2.8%	2.4%	1.1%	

Data Adapted from BEIS (2013b); BEIS (2014b); BEIS (2015b); BEIS (2016b); BEIS (2017b); BEIS (2018b); BEIS (2019b); BEIS (2020b)

Table Y.8 – 25+ Year Old's Perception of the Cause of the Current Change in the Climate between March 2013 and March 2020

	Climate change is entirely caused by natural processes	Climate change is mainly caused by natural processes	*NET NATURAL PROCESSES*	Climate change is partly caused by natural processes and partly caused by human activity	Climate change is mainly caused by human activity	Climate change is entirely caused by human activity	*NET HUMAN ACTIVITY*	I don't think there is such a thing as climate change	Don't Know	No opinion	Total
March 2013	95	135	230	734	470	190	660	74	47	23	**1,768**
	5.4%	7.6%	13.0%	41.5%	26.6%	10.7%	37.3%	4.2%	2.7%	1.3%	
March 2014	101	142	243	783	415	160	575	65	44	11	**1,721**
	5.9%	8.3%	14.1%	45.5%	24.1%	9.3%	33.4%	3.8%	2.6%	0.6%	
March 2015	73	157	230	739	440	183	623	56	46	23	**1,717**
	4.3%	9.1%	13.4%	43.0%	25.6%	10.7%	36.3%	3.3%	2.7%	1.3%	
March 2016	71	130	201	791	523	219	742	72	28	14	**1,848**
	3.8%	7.0%	10.9%	42.8%	28.3%	11.9%	40.2%	3.9%	1.5%	0.8%	
March 2017	82	130	212	842	499	257	756	74	22	12	**1,918**
	4.3%	6.8%	11.1%	43.9%	26.0%	13.4%	39.4%	3.9%	1.1%	0.6%	
March 2018	72	137	209	721	525	250	775	67	40	15	**1,827**
	3.9%	7.5%	11.4%	39.5%	28.7%	13.7%	42.4%	3.7%	2.2%	0.8%	
March 2019	108	196	304	1605	1099	529	1628	86	78	48	**3,749**
	2.9%	5.2%	8.1%	42.8%	29.3%	14.1%	43.4%	2.3%	2.1%	1.3%	
March 2020	44	90	134	639	468	252	720	36	41	24	**1,594**
	2.8%	5.6%	8.4%	40.1%	29.4%	15.8%	45.2%	2.3%	2.6%	1.5%	

Data Adapted from BEIS (2013b); BEIS (2014b); BEIS (2015b); BEIS (2016b); BEIS (2017b); BEIS (2018b); BEIS (2019b); BEIS (2020b)

Table Y.9 – Belief in the Cause of Climate Change amongst Different Socio Groups for 16 to 24 Year Olds, March 2019

		Climate change is entirely caused by natural processes	Climate change is mainly caused by natural processes	*NET NATURAL PROCESSES*	Climate change is partly caused by natural processes and partly caused by human activity	Climate change is mainly caused by human activity	Climate change is entirely caused by human activity	*NET HUMAN ACTIVITY*	I don't think there is such a thing as climate change	Don't Know	No opinion	Total
Gender	**Male**	3	9	12	60	107	46	153	5	5	2	**237**
		1.3%	3.8%	5.1%	25.3%	45.1%	19.4%	64.6%	2.1%	2.1%	0.8%	
	Female	4	5	9	82	84	45	129	4	7	7	**238**
		1.7%	2.1%	3.8%	34.5%	35.3%	18.9%	54.2%	1.7%	2.9%	2.9%	
Ethnicity	**White**	5	8	13	118	157	75	232	9	11	5	**388**
		1.3%	2.1%	3.4%	30.4%	40.5%	19.3%	59.8%	2.3%	2.8%	1.3%	
	Ethnic Minority	2	6	8	22	34	16	50	0	0	4	**84**
		2.4%	7.1%	9.5%	26.2%	40.5%	19.0%	59.5%	0.0%	0.0%	4.8%	
Area Type	**Urban**	7	12	19	116	155	80	235	6	12	9	**397**
		1.8%	3.0%	4.8%	29.2%	39.0%	20.2%	59.2%	1.5%	3.0%	2.3%	
	Rural	0	2	2	26	36	11	47	3	0	0	**78**
		0.0%	2.6%	2.6%	33.3%	46.2%	14.1%	60.3%	3.8%	0.0%	0.0%	
Social Group	**AB**	0	0	0	13	16	9	25	0	0	0	**38**
		0.0%	0.0%	0.0%	34.2%	42.1%	23.7%	65.8%	0.0%	0.0%	0.0%	
	C1	1	7	8	40	85	29	114	1	2	3	**168**
		0.6%	4.2%	4.8%	23.8%	50.6%	17.3%	67.9%	0.6%	1.2%	1.8%	
	C2	2	1	3	33	39	18	57	2	2	1	**98**
		2.0%	1.0%	3.1%	33.7%	39.8%	18.4%	58.2%	2.0%	2.0%	1.0%	
	DE	4	6	10	56	51	35	86	6	8	5	**171**
		2.3%	3.5%	5.8%	32.7%	29.8%	20.5%	50.3%	3.5%	4.7%	2.9%	

Data Adapted from BEIS (2019b)

Table Y.10 – Belief in the Cause of Climate Change amongst Different Socio Groups, March 2019

		Climate change is entirely caused by natural processes	Climate change is mainly caused by natural processes	*NET NATURAL PROCESSES*	Climate change is partly caused by natural processes and partly caused by human activity	Climate change is mainly caused by human activity	Climate change is entirely caused by human activity	*NET HUMAN ACTIVITY*	I don't think there is such a thing as climate change	Don't Know	No opinion	Total
Gender	**Male**	59	112	171	831	626	305	931	58	25	22	**2,038**
		2.9%	5.5%	8.4%	40.8%	30.7%	15.0%	45.7%	2.8%	1.2%	1.1%	
	Female	56	98	154	916	664	315	979	37	65	35	**2,186**
		2.6%	4.5%	7.0%	41.9%	30.4%	14.4%	44.8%	1.7%	3.0%	1.6%	
Ethnicity	**White**	99	183	282	1,560	1,145	544	1689	82	75	40	**3,728**
		2.7%	4.9%	7.6%	41.8%	30.7%	14.6%	45.3%	2.2%	2.0%	1.1%	
	Ethnic Minority	14	26	40	174	137	72	209	10	9	15	**457**
		3.1%	5.7%	8.8%	38.1%	30.0%	15.8%	45.7%	2.2%	2.0%	3.3%	
Area Type	**Urban**	96	155	251	1,328	986	518	1504	75	83	45	**3,286**
		2.9%	4.7%	7.6%	40.4%	30.0%	15.8%	45.8%	2.3%	2.5%	1.4%	
	Rural	19	55	74	419	304	102	406	20	7	12	**938**
		2.0%	5.9%	7.9%	44.7%	32.4%	10.9%	43.3%	2.1%	0.7%	1.3%	
Social Group	**AB**	15	27	42	293	286	125	411	7	6	2	**761**
		2.0%	3.5%	5.5%	38.5%	37.6%	16.4%	54.0%	0.9%	0.8%	0.3%	
	C1	21	46	67	439	403	146	549	13	12	9	**1,089**
		1.9%	4.2%	6.2%	40.3%	37.0%	13.4%	50.4%	1.2%	1.1%	0.8%	
	C2	23	43	66	384	234	122	356	23	18	9	**856**
		2.7%	5.0%	7.7%	44.9%	27.3%	14.3%	41.6%	2.7%	2.1%	1.1%	
	DE	56	94	150	631	367	227	594	52	54	37	**1,518**
		3.7%	6.2%	9.9%	41.6%	24.2%	15.0%	39.1%	3.4%	3.6%	2.4%	

		Climate change is entirely caused by natural processes	Climate change is mainly caused by natural processes	*NET NATURAL PROCESSES*	Climate change is partly caused by natural processes and partly caused by human activity	Climate change is mainly caused by human activity	Climate change is entirely caused by human activity	*NET HUMAN ACTIVITY*	I don't think there is such a thing as climate change	Don't Know	No opinion	Total
Region	NE England	7	11	18	72	62	30	92	1	4	1	**188**
		3.7%	5.9%	9.6%	38.3%	33.0%	16.0%	48.9%	0.5%	2.1%	0.5%	
	NW England	14	30	44	161	163	99	262	14	15	3	**499**
		2.8%	6.0%	8.8%	32.3%	32.7%	19.8%	52.5%	2.8%	3.0%	0.6%	
	Yorkshire & Humber	9	23	32	168	107	40	147	4	6	4	**361**
		2.5%	6.4%	8.9%	46.5%	29.6%	11.1%	40.7%	1.1%	1.7%	1.1%	
	East Midlands	11	13	24	156	66	41	107	11	3	2	**303**
		3.6%	4.3%	7.9%	51.5%	21.8%	13.5%	35.3%	3.6%	1.0%	0.7%	
	West Midlands	17	26	43	160	110	46	156	6	4	1	**370**
		4.6%	7.0%	11.6%	43.2%	29.7%	12.4%	42.2%	1.6%	1.1%	0.3%	
	East of England	14	16	30	144	110	51	161	15	7	10	**367**
		3.8%	4.4%	8.2%	39.2%	30.0%	13.9%	43.9%	4.1%	1.9%	2.7%	
	London	9	27	36	205	141	87	228	19	19	11	**518**
		1.7%	5.2%	6.9%	39.6%	27.2%	16.8%	44.0%	3.7%	3.7%	2.1%	
	SE England	13	20	33	255	174	82	256	5	15	9	**573**
		2.3%	3.5%	5.8%	44.5%	30.4%	14.3%	44.7%	0.9%	2.6%	1.6%	
	SW England	5	13	18	128	142	50	192	3	5	3	**349**
		1.4%	3.7%	5.2%	36.7%	40.7%	14.3%	55.0%	0.9%	1.4%	0.9%	
	Wales	10	11	21	88	59	28	87	3	1	4	**204**
		4.9%	5.4%	10.3%	43.1%	28.9%	13.7%	42.6%	1.5%	0.5%	2.0%	
	Scotland	6	16	22	170	110	41	151	8	11	9	**371**
		1.6%	4.3%	5.9%	45.8%	29.6%	11.1%	40.7%	2.2%	3.0%	2.4%	
	Northern Ireland	0	4	4	40	46	25	71	6	0	0	**121**
		0.0%	3.3%	3.3%	33.1%	38.0%	20.7%	58.7%	5.0%	0.0%	0.0%	

		Climate change is entirely caused by natural processes	Climate change is mainly caused by natural processes	*NET NATURAL PROCESSES*	Climate change is partly caused by natural processes and partly caused by human activity	Climate change is mainly caused by human activity	Climate change is entirely caused by human activity	*NET HUMAN ACTIVITY*	I don't think there is such a thing as climate change	Don't Know	No opinion	Total
Household Income	**< £16,000**	33	54	87	361	240	141	381	31	27	15	**902**
		3.7%	6.0%	9.6%	40.0%	26.6%	15.6%	42.2%	3.4%	3.0%	1.7%	
	£16,000 - £24,999	17	27	44	230	158	86	244	8	4	1	**531**
		3.2%	5.1%	8.3%	43.3%	29.8%	16.2%	46.0%	1.5%	0.8%	0.2%	
	£25,000 - £34,999	6	17	23	160	137	77	214	9	2	2	**410**
		1.5%	4.1%	5.6%	39.0%	33.4%	18.8%	52.2%	2.2%	0.5%	0.5%	
	£35,000 - £49,999	8	21	29	148	119	57	176	5	2	0	**360**
		2.2%	5.8%	8.1%	41.1%	33.1%	15.8%	48.9%	1.4%	0.6%	0.0%	
	>£49,999	6	7	13	119	146	63	209	1	2	0	**344**
		1.7%	2.0%	3.8%	34.6%	42.4%	18.3%	60.8%	0.3%	0.6%	0.0%	

NE England = North East England; NW England = North West England; Yorkshire & Humber = Yorkshire and the Humber; SE England = South East England; SW England = South West England

Data Adapted from BEIS (2019b)

Question 180 - Which of these describes your views about the impact of climate change in the UK?

Table Y.11 – Views about the impact of climate change in the United Kingdom, March 2019

		Climate change is already having an impact in the UK	Climate change is not yet having an impact, but will do in my lifetime	Climate will not have an impact in my lifetime, but will do for future generations in the UK	Climate change is not happening / will never have an impact in the UK	Don't Know / Refused
Overall		2,762	437	566	138	321
		65.4%	10.3%	13.4%	3.3%	7.6%
Age Group	**16-24**	319	61	49	11	35
		67.2%	12.8%	10.3%	2.3%	7.4%
	25-34	435	63	58	26	67
		67.0%	9.7%	8.9%	4.0%	10.3%
	35-44	400	63	49	15	48
		69.6%	11.0%	8.5%	2.6%	8.3%
	45-54	359	49	59	22	38
		68.1%	9.3%	11.2%	4.2%	7.2%
	55-64	415	57	95	17	27
		67.9%	9.3%	15.5%	2.8%	4.4%
	65+	834	144	256	47	106
		60.1%	10.4%	18.5%	3.4%	7.6%
Gender	**Male**	1,307	234	279	65	153
		64.1%	11.5%	13.7%	3.2%	7.5%
	Female	1,455	203	287	73	168
		66.6%	9.3%	13.1%	3.3%	7.7%
Ethnicity	**White**	2,442	392	519	118	257
		65.5%	10.5%	13.9%	3.2%	6.9%
	Ethnic Minority	300	44	43	16	54
		65.6%	9.6%	9.4%	3.5%	11.8%
Area Type	**Urban**	2,138	337	452	109	250
		65.1%	10.3%	13.8%	3.3%	7.6%
	Rural	624	100	114	29	71
		66.5%	10.7%	12.2%	3.1%	7.6%
Social Class	**AB**	555	76	90	16	24
		72.9%	10.0%	11.8%	2.1%	3.2%
	C1	760	101	146	32	50
		69.8%	9.3%	13.4%	2.9%	4.6%
	C2	555	100	103	32	66
		64.8%	11.7%	12.0%	3.7%	7.7%
	DE	892	160	227	58	181
		58.8%	10.5%	15.0%	3.8%	11.9%

Table Y.11 – Views about the impact of climate change in the UK, March 2019 (Continued)

		Climate change is already having an impact in the UK	Climate change is not yet having an impact, but will do in my lifetime	Climate will not have an impact in my lifetime, but will do for future generations in the UK	Climate change is not happening / will never have an impact in the UK	Don't Know / Refused
Region	**North East England**	128	18	29	8	5
		68.1%	9.6%	15.4%	4.3%	2.7%
	North West England	310	72	72	17	28
		62.1%	14.4%	14.4%	3.4%	5.6%
	Yorkshire & the Humber	241	42	50	7	21
		66.8%	11.6%	13.9%	1.9%	5.8%
	East Midlands	191	26	44	19	23
		63.0%	8.6%	14.5%	6.3%	7.6%
	West Midlands	219	41	77	16	17
		59.2%	11.1%	20.8%	4.3%	4.6%
	East of England	240	27	34	16	50
		65.4%	7.4%	9.3%	4.4%	13.6%
	London	353	36	48	15	66
		68.10%	6.90%	9.30%	2.90%	12.70%
	South East England	394	61	62	11	45
		68.8%	10.6%	10.8%	1.9%	7.9%
	South West England	249	32	41	9	18
		71.3%	9.2%	11.7%	2.6%	5.2%
	Wales	126	30	30	7	11
		61.8%	14.7%	14.7%	3.4%	5.4%
	Scotland	215	43	71	13	29
		58.0%	11.6%	19.1%	3.5%	7.8%
	Northern Ireland	96	9	8	0	8
		79.3%	7.4%	6.6%	0.0%	6.6%
Household Income	**<£16,000**	568	91	132	37	74
		63.0%	10.1%	14.6%	4.1%	8.2%
	£16,000 - £24,999	355	54	81	14	27
		66.9%	10.2%	15.3%	2.6%	5.1%
	£25,000 - £34,999	291	48	46	10	15
		71.0%	11.7%	11.2%	2.4%	3.7%
	£35,000 - £49,999	253	42	48	8	9
		70.3%	11.7%	13.3%	2.2%	2.5%
	£50,000+	268	37	32	5	2
		77.9%	10.8%	9.3%	1.5%	0.6%

Data Adapted from BEIS (2019b)

Table Y.12 – Views about the impact of climate change in the UK, March 2020

		Climate change is already having an impact in the UK	Climate change is not yet having an impact, but will do in my lifetime	Climate will not have an impact in my lifetime, but will do for future generations in the UK	Climate change is not happening / will never have an impact in the UK	Don't Know / Refused
Overall		1,219	206	231	52	143
		65.9%	11.1%	12.5%	2.8%	7.7%
Age Group	**16-24**	182	31	17	7	20
		70.8%	12.1%	6.6%	2.7%	7.8%
	25-34	193	40	33	7	18
		66.3%	13.7%	11.3%	2.4%	6.2%
	35-44	157	25	34	10	24
		62.8%	10.0%	13.6%	4.0%	9.6%
	45-54	165	31	30	10	12
		66.5%	12.5%	12.1%	4.0%	4.8%
	55-64	181	32	33	5	18
		67.3%	11.9%	12.3%	1.9%	6.7%
	65+	341	47	84	13	51
		63.6%	8.8%	15.7%	2.4%	9.5%
Gender	**Male**	575	105	111	31	63
		65.0%	11.9%	12.5%	3.5%	7.1%
	Female	644	101	120	21	80
		66.7%	10.5%	12.4%	2.2%	8.3%
Ethnicity	**White**	1,090	181	195	40	120
		67.0%	11.1%	12.0%	2.5%	7.4%
	Ethnic Minority	117	23	32	10	21
		57.6%	11.3%	15.8%	4.9%	10.3%
Area Type	**Urban**	929	155	176	38	121
		65.5%	10.9%	12.4%	2.7%	8.5%
	Rural	290	51	55	14	22
		67.1%	11.8%	12.7%	3.2%	5.1%
Social Class	**AB**	290	20	24	10	8
		82.4%	5.7%	6.8%	2.8%	2.3%
	C1	391	51	67	11	25
		71.70%	9.40%	12.30%	2.00%	4.60%
	C2	229	56	56	9	35
		59.5%	14.5%	14.5%	2.3%	9.1%
	DE	309	79	84	22	75
		54.3%	13.9%	14.8%	3.9%	13.2%

Data Adapted from BEIS (2020b)

Table Y.12 – Differing views about the impact of climate change in the UK between March 2019 and March 2020

		Climate change is already having an impact in the UK	Climate change is not yet having an impact, but will do in my lifetime	Climate will not have an impact in my lifetime, but will do for future generations in the UK	Climate change is not happening / will never have an impact in the UK	Don't Know / Refused
Overall		+ 0.5%	+ 0.8%	- 0.9%	- 0.5%	+ 0.1%
Age Group	**16-24**	+ 3.6%	- 0.7%	- 3.7%	+ 0.4%	+ 0.4%
	25-34	- 0.7%	+ 4.0%	+ 2.4%	- 1.6%	- 4.1%
	35-44	- 6.8%	- 1.0%	+ 5.1%	+ 1.4%	+ 1.3%
	45-54	- 1.6%	+ 3.2%	+ 0.9%	- 0.2%	- 2.4%
	55-64	- 0.6%	+ 2.6%	- 3.2%	- 0.9%	+ 2.3%
	65+	+ 3.5%	- 1.6%	- 2.8%	- 1.0%	+ 1.9%
Gender	**Male**	+ 0.9%	+ 0.4%	- 1.2%	+ 0.3%	- 0.4%
	Female	+ 0.1%	+ 1.2%	- 0.7%	- 1.1%	+ 0.6%
Ethnicity	**White**	+ 1.5%	+ 0.6%	- 1.9%	- 0.7%	+ 0.5%
	EM	- 8.0%	+ 1.7%	+ 6.4%	+ 1.4%	- 1.5%
Area Type	**Urban**	+ 0.4%	+ 0.6%	- 1.4%	- 0.6%	+ 0.9%
	Rural	+ 0.6%	+ 1.1%	+ 0.5%	+ 0.1%	- 2.5%
Social Class	**AB**	+ 9.5%	- 4.3%	- 5.0%	+ 0.7%	- 0.9%
	C1	+ 1.9%	+ 0.1%	- 1.1%	- 0.9%	= 0.0%
	C2	- 5.3%	+ 2.8%	+ 2.5%	- 1.4%	+ 1.4%
	DE	- 4.5%	+ 3.4%	- 0.2%	+ 0.1%	+ 1.3%

Data Adapted from BEIS (2019b) and BEIS (2020b)

Question 182 – Thinking just about the UK, have you noticed any impacts of climate change over the past few years? If so, which ones?

Table Y.13 – Proportion of respondents that believe rising sea levels and/or more flooding are already occurring within the United Kingdom due to climate change

Socio-Economic Factors		**March 2019**	**March 2020**	**Diff.**	**Sig.**
Age	16-24	120 (25.8%)	112 (44.1%)	+ 18.3%	0.000***
	25-34	197 (31.1%)	129 (44.6%)	+ 13.5%	0.000***
	35-44	186 (33.3%)	99 (41.4%)	+ 8.1%	0.028**
	45-54	182 (35.2%)	128 (52.5%)	+ 17.3%	0.000***
	55-64	176 (29.3%)	148 (55.8%)	+ 26.5%	0.000***
	65+	365 (27.0%)	274 (52.6%)	+ 25.6%	0.000***
Gender	Male	561 (28.3%)	425 (49.5%)	+ 21.2%	0.000***
	Female	665 (30.9%)	465 (48.7%)	+ 17.8%	0.000***
Social Class	AB	250 (33.2%)	224 (64.6%)	+ 31.4%	0.000***
	C1	335 (31.1%)	265 (49.2%)	+ 18.1%	0.000***
	C2	254 (30.5%)	177 (47.6%)	+ 17.1%	0.000***
	DE	387 (26.4%)	224 (40.4%)	+ 14.0%	0.000***
Ethnicity	White	1,092 (30.0%)	8252 (51.8%)	+ 21.8%	0.000***
	Ethnic Minority	126 (28.2%)	61 (30.8%)	+ 2.6%	0.499
Household Income	< £16,000	240 (27.6%)	-	-	-
	£16,000 - £24,999	180 (34.4%)	-	-	-
	£25,000 - £34,999	133 (33.2%)	-	-	-
	£35,000 - £49,999	119 (33.5%)	-	-	-
	>£49,999	111 (32.4%)	-	-	-
Area Type	Urban	931 (29.0%)	645 (46.6%)	+ 17.6%	0.000***
	Rural	295 (32.1%)	245 (57.4%)	+ 25.3%	0.000***
Region	North East England	59 (31.6%)	-	-	-
	North West England	144 (29.7%)	-	-	-
	Yorkshire and the Humber	102 (28.6%)	-	-	-
	East Midlands	74 (25.3%)	-	-	-
	West Midlands	119 (32.7%)	-	-	-
	East of England	69 (19.6%)	-	-	-
	London	127 (25.5%)	-	-	-
	South East England	186 (32.7%)	-	-	-
	South West England	136 (39.3%)	-	-	-
	Wales	68 (33.8%)	-	-	-
	Scotland	98 (27.0%)	-	-	-
	Northern Ireland	44 (38.3%)	-	-	-
Total		**1,226 (29.7%)**	**890 (49.1%)**	**+ 19.4%**	**0.000*** **

Sig. = Significance; Diff. = Difference; ** = 95 per cent significance; * = 99 per cent significance.**

Data Adapted from BEIS (2019b) and BEIS (2020b)

Table Y.14 – Proportion of respondents that believe a reduction of food availability and/or impact on farming are already occurring within the United Kingdom due to climate change

Socio-Economic Factors		**March 2019**	**March 2020**	**Diff.**	**Sig.**
Age	16-24	45 (9.7%)	28 (11.0%)	+ 1.3%	0.561
	25-34	69 (10.9%)	35 (12.1%)	+ 1.2%	0.590
	35-44	45 (8.1%)	16 (6.7%)	- 1.4%	0.509
	45-54	44 (8.5%)	22 (9.0%)	+ 0.5%	0.817
	55-64	49 (8.2%)	17 (6.4%)	- 1.8%	0.374
	65+	78 (5.8%)	42 (8.1%)	- 2.3%	0.069*
Gender	Male	151 (7.6%)	78 (9.1%)	+ 1.5%	0.188
	Female	179 (8.3%)	82 (8.6%)	+ 0.3%	0.805
Social Class	AB	49 (6.5%)	23 (6.6%)	+ 0.1%	0.936
	C1	90 (8.4%)	42 (7.8%)	- 0.6%	0.692
	C2	75 (9.0%)	40 (10.8%)	+ 1.8%	0.340
	DE	116 (7.9%)	55 (9.9%)	+ 2.0%	0.147
Ethnicity	White	281 (7.7%)	138 (8.7%)	+ 1.0%	0.241
	Ethnic Minority	47 (10.5%)	21 (10.6%)	+ 0.1%	0.972
Household Income	< £16,000	85 (9.8%)	-	-	-
	£16,000 - £24,999	57 (10.9%)	-	-	-
	£25,000 - £34,999	32 (8.0%)	-	-	-
	£35,000 - £49,999	29 (8.2%)	-	-	-
	>£49,999	24 (7.0%)	-	-	-
Area Type	Urban	274 (8.5%)	118 (8.5%)	= 0.0%	0.988
	Rural	56 (6.1%)	42 (9.8%)	+ 3.7%	0.014**
Region	North East England	14 (7.5%)	-	-	-
	North West England	25 (5.2%)	-	-	-
	Yorkshire and the Humber	12 (3.4%)	-	-	-
	East Midlands	26 (8.9%)	-	-	-
	West Midlands	37 (10.2%)	-	-	-
	East of England	20 (5.7%)	-	-	-
	London	51 (10.2%)	-	-	-
	South East England	65 (11.4%)	-	-	-
	South West England	34 (9.8%)	-	-	-
	Wales	11 (5.5%)	-	-	-
	Scotland	35 (9.6%)	-	-	-
	Northern Ireland	0 (0.0%)	-	-	-
Total		**330 (8.0%)**	**160 (8.8%)**	**+ 0.8%**	**0.280**

Sig. = Significance; Diff. = Difference; * = 90 per cent significance; ** = 95 per cent significance.

Data Adapted from BEIS (2019b) and BEIS (2020b)

Table Y.15 – Proportion of respondents that believe a reduction of water availability and/or increased frequency/magnitude of droughts are already occurring within the United Kingdom due to climate change

Socio-Economic Factors		March 2019	March 2020	Diff.	Sig.
Age	16-24	44 (9.4%)	26 (10.2%)	+ 0.8%	0.731
	25-34	66 (10.4%)	33 (11.4%)	+ 1.0%	0.652
	35-44	66 (11.8%)	21 (8.8%)	- 2.0%	0.210
	45-54	67 (13.0%)	20 (8.2%)	- 4.8%	0.054*
	55-64	64 (10.6%)	21 (7.9%)	- 2.7%	0.214
	65+	116 (8.6%)	35 (6.7%)	- 1.9%	0.186
Gender	Male	199 (10.1%)	76 (8.9%)	- 1.2%	0.324
	Female	224 (10.4%)	80 (8.4%)	- 2.0%	0.078*
Social Class	AB	81 (10.7%)	38 (11.0%)	+ 0.3%	0.918
	C1	117 (10.9%)	56 (10.4%)	- 0.5%	0.767
	C2	97 (11.6%)	27 (7.3%)	- 4.3%	0.021**
	DE	128 (8.7%)	35 (6.3%)	- 2.4%	0.076*
Ethnicity	White	362 (9.9%)	132 (8.3%)	- 1.6%	0.061*
	Ethnic Minority	58 (13.0%)	23 (11.6%)	- 1.4%	0.631
Household Income	< £16,000	88 (10.1%)	-	-	-
	£16,000 - £24,999	72 (13.8%)	-	-	-
	£25,000 - £34,999	36 (9.0%)	-	-	-
	£35,000 - £49,999	37 (10.4%)	-	-	-
	>£49,999	48 (14.0%)	-	-	-
Area Type	Urban	342 (10.7%)	125 (9.0%)	- 1.7%	0.094*
	Rural	81 (8.8%)	31 (7.3%)	- 1.5%	0.334
Region	North East England	17 (9.1%)	-	-	-
	North West England	36 (7.4%)	-	-	-
	Yorkshire and the Humber	23 (6.4%)	-	-	-
	East Midlands	32 (11.0%)	-	-	-
	West Midlands	45 (12.4%)	-	-	-
	East of England	33 (9.4%)	-	-	-
	London	70 (14.0%)	-	-	-
	South East England	82 (14.4%)	-	-	-
	South West England	47 (13.6%)	-	-	-
	Wales	13 (6.5%)	-	-	-
	Scotland	24 (6.6%)	-	-	-
	Northern Ireland	1 (0.9%)	-	-	-
Total		**423 (10.2%)**	**156 (8.6%)**	**- 1.6%**	**0.050****

Sig. = Significance; Diff. = Difference; * = 90 per cent significance; ** = 95 per cent significance.

Data Adapted from BEIS (2019b) and BEIS (2020b)

Table Y.16 – Proportion of respondents that believe a change in plants or wildlife [including plants and animal extinctions] are already occurring within the United Kingdom due to climate change

Socio-Economic Factors		March 2019	March 2020	Diff.	Sig.
Age	16-24	69 (14.8%)	36 (14.2%)	- 0.6%	0.818
	25-34	101 (16.0%)	39 (13.5%)	- 2.5%	0.334
	35-44	80 (14.3%)	31 (13.0%)	- 1.3%	0.616
	45-54	82 (15.9%)	29 (11.9%)	- 4.0%	0.147
	55-64	85 (14.1%)	33 (12.5%)	- 1.6%	0.504
	65+	181 (13.4%)	66 (12.7%)	- 0.7%	0.684
Gender	Male	271 (13.7%)	106 (12.4%)	- 1.3%	0.337
	Female	327 (15.2%)	128 (13.4%)	- 1.8%	0.191
Social Class	AB	111 (14.7%)	50 (14.4%)	- 0.3%	0.892
	C1	162 (15.1%)	80 (14.8%)	- 0.3%	0.910
	C2	129 (15.5%)	47 (12.6%)	- 2.9%	0.195
	DE	196 (13.4%)	57 (10.3%)	- 3.1%	0.062*
Ethnicity	White	524 (14.4%)	208 (13.1%)	- 1.3%	0.207
	Ethnic Minority	70 (15.7%)	23 (11.6%)	- 4.1%	0.178
Household Income	< £16,000	150 (17.2%)	-	-	-
	£16,000 - £24,999	90 (17.2%)	-	-	-
	£25,000 - £34,999	56 (14.0%)	-	-	-
	£35,000 - £49,999	66 (18.6%)	-	-	-
	>£49,999	42 (12.2%)	-	-	-
Area Type	Urban	474 (14.8%)	169 (12.2%)	- 2.6%	0.022**
	Rural	124 (13.5%)	65 (15.2%)	+ 1.7%	0.400
Region	North East England	24 (12.8%)	-	-	-
	North West England	33 (6.8%)	-	-	-
	Yorkshire and the Humber	43 (12.0%)	-	-	-
	East Midlands	36 (12.3%)	-	-	-
	West Midlands	65 (17.9%)	-	-	-
	East of England	33 (9.4%)	-	-	-
	London	77 (15.4%)	-	-	-
	South East England	89 (15.7%)	-	-	-
	South West England	84 (24.3%)	-	-	-
	Wales	21 (10.4%)	-	-	-
	Scotland	87 (24.0%)	-	-	-
	Northern Ireland	6 (5.2%)	-	-	-
Total		**598 (14.5%)**	**234 (12.9%)**	**- 1.6%**	**0.109**

Sig. = Significance; Diff. = Difference; * = 90 per cent significance; ** = 95 per cent significance.

Data Adapted from BEIS (2019b) and BEIS (2020b)

Table Y.17 – Proportion of respondents that believe that more health problem [e.g. asthma] are already occurring within the United Kingdom due to climate change

Socio-Economic Factors		**March 2019**	**March 2020**	**Diff.**	**Sig.**
Age	16-24	58 (12.4%)	39 (15.4%)	+ 3.0%	0.275
	25-34	109 (17.2%)	58 (20.1%)	+ 2.9%	0.297
	35-44	94 (16.8%)	36 (15.1%)	- 1.7%	0.539
	45-54	72 (13.9%)	32 (13.1%)	- 0.8%	0.761
	55-64	80 (13.3%)	33 (12.5%)	- 0.8%	0.730
	65+	120 (8.9%)	66 (12.7%)	+ 3.8%	0.014**
Gender	Male	226 (11.4%)	121 (14.1%)	+ 2.7%	0.045**
	Female	307 (14.3%)	143 (15.0%)	+ 0.7%	0.607
Social Class	AB	68 (9.0%)	51 (14.7%)	+ 5.7%	0.005***
	C1	147 (13.7%)	83 (15.4%)	+ 1.7%	0.346
	C2	129 (15.5%)	57 (15.3%)	- 0.3%	0.942
	DE	189 (12.9%)	73 (13.2%)	+ 0.3%	0.865
Ethnicity	White	437 (12.0%)	213 (13.4%)	+ 1.4%	0.162
	Ethnic Minority	91 (20.4%)	49 (24.7%)	+ 4.3%	0.212
Household Income	< £16,000	127 (14.6%)	-	-	-
	£16,000 - £24,999	83 (15.9%)	-	-	-
	£25,000 - £34,999	67 (16.7%)	-	-	-
	£35,000 - £49,999	50 (14.1%)	-	-	-
	>£49,999	35 (10.2%)	-	-	-
Area Type	Urban	422 (13.1%)	209 (15.1%)	+ 2.0%	0.078*
	Rural	111 (12.1%)	55 (12.9%)	+ 0.8%	0.682
Region	North East England	13 (7.0%)	-	-	-
	North West England	29 (6.0%)	-	-	-
	Yorkshire and the Humber	37 (10.4%)	-	-	-
	East Midlands	53 (18.2%)	-	-	-
	West Midlands	52 (14.3%)	-	-	-
	East of England	32 (9.1%)	-	-	-
	London	94 (18.8%)	-	-	-
	South East England	74 (13.0%)	-	-	-
	South West England	53 (15.3%)	-	-	-
	Wales	15 (7.5%)	-	-	-
	Scotland	58 (16.0%)	-	-	-
	Northern Ireland	23 (20.0%)	-	-	-
Total		**533 (12.9%)**	**264 (14.6%)**	**+ 1.7%**	**0.084***

Sig. = Significance; Diff. = Difference; * = 90 per cent significance; ** = 95 per cent significance; * = 99 per cent significance.**

Data Adapted from BEIS (2019b) and BEIS (2020b)

Table Y.18 – Proportion of respondents that believe rising temperatures and/or hotter summers are already occurring within the United Kingdom due to climate change

Socio-Economic Factors		March 2019	March 2020	Diff.	Sig.
Age	16-24	242 (51.9%)	100 (39.4%)	- 12.5%	0.001***
	25-34	335 (52.9%)	117 (40.5%)	- 12.4%	0.000***
	35-44	295 (52.8%)	89 (37.2%)	- 15.6%	0.000***
	45-54	257 (49.7%)	77 (31.6%)	- 18.1%	0.000***
	55-64	297 (49.4%)	101 (38.1%)	- 11.3%	0.002***
	65+	579 (42.8%)	174 (33.4%)	- 9.4%	0.000***
Gender	Male	959 (48.4%)	321 (37.4%)	- 11.0%	0.000***
	Female	1,046 (48.7%)	337 (35.3%)	- 13.4%	0.000***
Social Class	AB	420 (55.7%)	158 (45.5%)	- 10.1%	0.002***
	C1	562 (52.2%)	230 (42.7%)	- 9.5%	0.000***
	C2	378 (45.4%)	116 (31.2%)	- 14.2%	0.000***
	DE	645 (44.0%)	154 (27.8%)	- 16.2%	0.000***
Ethnicity	White	1,741 (47.8%)	573 (36.0%)	- 11.8%	0.000***
	Ethnic Minority	249 (55.7%)	79 (39.9%)	- 15.8%	0.000***
Household Income	< £16,000	385 (44.2%)	-	-	-
	£16,000 - £24,999	255 (48.8%)	-	-	-
	£25,000 - £34,999	210 (52.4%)	-	-	-
	£35,000 - £49,999	195 (54.9%)	-	-	-
	>£49,999	196 (57.1%)	-	-	-
Area Type	Urban	1,579 (49.2%)	510 (36.8%)	- 12.4%	0.000***
	Rural	426 (46.4%)	148 (34.7%)	- 11.7%	0.000***
Region	North East England	96 (51.3%)	-	-	-
	North West England	206 (42.5%)	-	-	-
	Yorkshire and the Humber	170 (47.6%)	-	-	-
	East Midlands	129 (44.2%)	-	-	-
	West Midlands	183 (50.3%)	-	-	-
	East of England	203 (57.7%)	-	-	-
	London	284 (56.9%)	-	-	-
	South East England	322 (56.7%)	-	-	-
	South West England	163 (47.1%)	-	-	-
	Wales	92 (45.8%)	-	-	-
	Scotland	138 (38.0%)	-	-	-
	Northern Ireland	19 (16.5%)	-	-	-
Total		**2,005 (48.6%)**	**658 (36.3%)**	**- 12.3%**	**0.000*** **

Sig. = Significance; Diff. = Difference; * = 99 per cent significance.**

Data Adapted from BEIS (2019b) and BEIS (2020b)

Table Y.19 – Proportion of respondents that believe more extreme events [including storms] are already occurring within the United Kingdom due to climate change

Socio-Economic Factors		March 2019	March 2020	Diff.	Sig.
Age	16-24	123 (26.4%)	83 (32.7%)	+ 6.3%	0.075*
	25-34	182 (28.8%)	97 (33.6%)	+ 4.8%	0.140
	35-44	163 (29.2%)	79 (33.1%)	+ 3.9%	0.273
	45-54	159 (30.8%)	70 (28.7%)	- 2.1%	0.562
	55-64	205 (34.1%)	85 (32.1%)	- 2.0%	0.559
	65+	371 (27.4%)	179 (34.4%)	- 7.0%	0.003***
Gender	Male	567 (28.6%)	299 (34.8%)	+ 6.2%	0.001***
	Female	636 (29.6%)	294 (30.8%)	+ 1.2%	0.493
Social Class	AB	263 (34.9%)	140 (40.3%)	+ 5.4%	0.080*
	C1	321 (29.8%)	176 (32.7%)	+ 2.9%	0.247
	C2	224 (26.9%)	119 (32.0%)	+ 5.1%	0.070*
	DE	395 (26.9%)	158 (28.5%)	+ 1.6%	0.479
Ethnicity	White	1,101 (30.2%)	533 (33.5%)	+ 3.3%	0.019**
	Ethnic Minority	96 (21.5%)	54 (27.3%)	+ 5.8%	0.108
Household Income	< £16,000	232 (26.6%)	-	-	-
	£16,000 - £24,999	186 (35.6%)	-	-	-
	£25,000 - £34,999	131 (32.7%)	-	-	-
	£35,000 - £49,999	123 (34.6%)	-	-	-
	>£49,999	108 (31.5%)	-	-	-
Area Type	Urban	936 (29.1%)	440 (31.8%)	+ 2.7%	0.075*
	Rural	267 (29.1%)	153 (35.8%)	+ 6.7%	0.013**
Region	North East England	52 (27.8%)	-	-	-
	North West England	139 (28.7%)	-	-	-
	Yorkshire and the Humber	76 (21.3%)	-	-	-
	East Midlands	77 (26.4%)	-	-	-
	West Midlands	110 (30.2%)	-	-	-
	East of England	66 (18.8%)	-	-	-
	London	109 (21.8%)	-	-	-
	South East England	174 (30.6%)	-	-	-
	South West England	148 (42.8%)	-	-	-
	Wales	75 (37.3%)	-	-	-
	Scotland	117 (32.2%)	-	-	-
	Northern Ireland	60 (52.2%)	-	-	-
Total		**1,203 (29.1%)**	**593 (32.7%)**	**+ 3.6%**	**0.006*** **

Sig. = Significance; Diff. = Difference; * = 90 per cent significance; ** = 95 per cent significance; * = 99 per cent significance.**

Data Adapted from BEIS (2019b) and BEIS (2020b)

Table Y.20 – Proportion of respondents that believe increased pollution is already occurring within the United Kingdom due to climate change

Socio-Economic Factors		March 2019	March 2020	Diff.	Sig.
Age	16-24	90 (19.3%)	50 (19.7%)	+ 0.4%	0.904
	25-34	137 (21.6%)	60 (20.8%)	- 0.8%	0.762
	35-44	110 (19.7%)	44 (18.4%)	- 1.3%	0.678
	45-54	84 (16.2%)	30 (12.3%)	- 3.9%	0.154
	55-64	106 (17.6%)	33 (12.5%)	- 5.1%	0.055*
	65+	147 (10.9%)	64 (12.4%)	+ 1.5%	0.384
Gender	Male	320 (16.2%)	145 (16.9%)	+ 0.7%	0.626
	Female	354 (16.5%)	136 (14.3%)	- 2.2%	0.118
Social Class	AB	98 (13.0%)	59 (17.0%)	+ 4.0%	0.077*
	C1	196 (18.2%)	82 (15.2%)	- 3.0%	0.132
	C2	150 (18.0%)	57 (15.3%)	- 2.7%	0.254
	DE	230 (15.7%)	83 (15.0%)	- 0.7%	0.695
Ethnicity	White	549 (15.1%)	233 (14.6%)	- 0.5%	0.687
	Ethnic Minority	123 (27.5%)	46 (23.2%)	- 4.3%	0.254
Household Income	< £16,000	152 (17.5%)	-	-	-
	£16,000 - £24,999	92 (17.6%)	-	-	-
	£25,000 - £34,999	88 (21.9%)	-	-	-
	£35,000 - £49,999	68 (19.2%)	-	-	-
	>£49,999	51 (14.9%)	-	-	-
Area Type	Urban	536 (16.7%)	229 (16.5%)	- 0.2%	0.895
	Rural	138 (15.0%)	52 (12.2%)	- 2.8%	0.162
Region	North East England	22 (11.8%)	-	-	-
	North West England	42 (8.7%)	-	-	-
	Yorkshire and the Humber	28 (7.8%)	-	-	-
	East Midlands	82 (28.1%)	-	-	-
	West Midlands	65 (17.9%)	-	-	-
	East of England	37 (10.5%)	-	-	-
	London	137 (27.5%)	-	-	-
	South East England	102 (18.0%)	-	-	-
	South West England	68 (19.7%)	-	-	-
	Wales	29 (14.4%)	-	-	-
	Scotland	40 (11.0%)	-	-	-
	Northern Ireland	22 (19.1%)	-	-	-
Total		**674 (16.3%)**	**281 (15.5%)**	**- 0.8%**	**0.431**

Sig. = Significance; Diff. = Difference; * = 90 per cent significance.

Data Adapted from BEIS (2019b) and BEIS (2020b)

Table Y.21 – Proportion of respondents that believe increased frequency/magnitude of wildfires are already occurring within the United Kingdom due to climate change

Socio-Economic Factors		March 2019	March 2020	Diff.	Sig.
Age	16-24	33 (7.1%)	21 (8.3%)	+ 1.2%	0.564
	25-34	47 (7.4%)	25 (8.7%)	+ 1.3%	0.520
	35-44	40 (7.2%)	15 (6.3%)	- 0.9%	0.653
	45-54	38 (7.4%)	10 (4.1%)	- 3.3%	0.085*
	55-64	44 (7.3%)	10 (3.8%)	- 3.5%	0.047**
	65+	69 (5.1%)	35 (6.7%)	+ 1.6%	0.170
Gender	Male	115 (5.8%)	56 (6.5%)	+ 0.7%	0.460
	Female	156 (7.3%)	60 (6.3%)	- 1.0%	0.327
Social Class	AB	57 (7.6%)	23 (6.6%)	- 1.0%	0.580
	C1	79 (7.3%)	38 (7.1%)	- 0.2%	0.831
	C2	62 (7.4%)	24 (6.5%)	- 0.9%	0.537
	DE	73 (5.0%)	31 (5.6%)	+ 0.6%	0.576
Ethnicity	White	239 (6.6%)	106 (6.7%)	+ 0.1%	0.894
	Ethnic Minority	30 (6.7%)	10 (5.1%)	- 1.6%	0.420
Household Income	< £16,000	58 (6.7%)	-	-	-
	£16,000 - £24,999	46 (8.8%)	-	-	-
	£25,000 - £34,999	24 (6.0%)	-	-	-
	£35,000 - £49,999	40 (11.3%)	-	-	-
	>£49,999	19 (5.5%)	-	-	-
Area Type	Urban	224 (7.0%)	89 (6.4%)	- 0.6%	0.497
	Rural	47 (5.1%)	27 (6.3%)	+ 1.2%	0.368
Region	North East England	14 (7.5%)	-	-	-
	North West England	25 (5.2%)	-	-	-
	Yorkshire and the Humber	12 (3.4%)	-	-	-
	East Midlands	24 (8.2%)	-	-	-
	West Midlands	26 (7.1%)	-	-	-
	East of England	10 (2.8%)	-	-	-
	London	29 (5.8%)	-	-	-
	South East England	50 (8.8%)	-	-	-
	South West England	31 (9.0%)	-	-	-
	Wales	17 (8.5%)	-	-	-
	Scotland	31 (8.5%)	-	-	-
	Northern Ireland	2 (1.7%)	-	-	-
Total		**271 (6.6%)**	**116 (6.4%)**	**- 0.2%**	**0.816**

Sig. = Significance; Diff. = Difference; * = 90 per cent significance; ** = 95 per cent significance.

Data Adapted from BEIS (2019b) and BEIS (2020b)

Table Y.22 – Proportion of respondents that believe increased frequency of coastal erosion is already occurring within the United Kingdom due to climate change

Socio-Economic Factors		March 2019	March 2020	Diff.	Sig.
Age	16-24	39 (8.4%)	21 (8.3%)	- 0.1%	0.962
	25-34	49 (7.7%)	30 (10.4%)	+ 2.7%	0.184
	35-44	58 (10.4%)	20 (8.4%)	- 2.0%	0.382
	45-54	61 (11.8%)	31 (12.7%)	+ 0.9%	0.720
	55-64	79 (13.1%)	36 (13.6%)	+ 0.5%	0.860
	65+	127 (9.4%)	70 (13.4%)	+ 4.0%	0.010***
Gender	Male	197 (9.9%)	102 (11.9%)	+ 2.0%	0.122
	Female	216 (10.1%)	106 (11.1%)	+ 1.0%	0.372
Social Class	AB	85 (11.3%)	46 (13.3%)	+ 2.0%	0.345
	C1	123 (11.4%)	61 (11.3%)	- 0.1%	0.946
	C2	85 (10.2%)	43 (11.6%)	+ 1.4%	0.481
	DE	120 (8.2%)	58 (10.5%)	+ 2.3%	0.106
Ethnicity	White	377 (10.3%)	200 (12.6%)	+ 2.3%	0.018**
	Ethnic Minority	34 (7.6%)	8 (4.0%)	- 3.6%	0.090*
Household Income	< £16,000	83 (9.5%)	-	-	-
	£16,000 - £24,999	68 (13.0%)	-	-	-
	£25,000 - £34,999	58 (14.5%)	-	-	-
	£35,000 - £49,999	47 (13.2%)	-	-	-
	>£49,999	31 (9.0%)	-	-	-
Area Type	Urban	294 (9.2%)	146 (10.5%)	+ 1.3%	0.143
	Rural	119 (13.0%)	62 (14.5%)	+ 1.5%	0.436
Region	North East England	16 (8.6%)	-	-	-
	North West England	31 (6.4%)	-	-	-
	Yorkshire and the Humber	26 (7.3%)	-	-	-
	East Midlands	24 (8.2%)	-	-	-
	West Midlands	20 (5.5%)	-	-	-
	East of England	39 (11.1%)	-	-	-
	London	39 (7.8%)	-	-	-
	South East England	62 (10.9%)	-	-	-
	South West England	65 (18.8%)	-	-	-
	Wales	24 (11.9%)	-	-	-
	Scotland	40 (11.0%)	-	-	-
	Northern Ireland	27 (23.5%)	-	-	-
Total		**413 (10.0%)**	**208 (11.5%)**	**+ 1.5%**	**0.087***

Sig. = Significance; Diff. = Difference; * = 90 per cent significance; ** = 95 per cent significance; * = 99 per cent significance.**

Data Adapted from BEIS (2019b) and BEIS (2020b)

Table Y.23 – Proportion of respondents that believe changes to the seasons and/or erratic weather patterns are already occurring within the United Kingdom due to climate change

Socio-Economic Factors		March 2019	March 2020	Diff.	Sig.
Age	16-24	10 (2.1%)	3 (1.2%)	- 0.9%	0.353
	25-34	19 (3.0%)	5 (1.7%)	- 1.3%	0.261
	35-44	17 (3.0%)	9 (3.8%)	+ 0.8%	0.597
	45-54	24 (4.6%)	12 (4.9%)	+ 0.3%	0.867
	55-64	26 (4.3%)	12 (4.5%)	+ 0.2%	0.894
	65+	62 (4.6%)	16 (3.1%)	- 1.5%	0.142
Gender	Male	68 (3.4%)	24 (2.8%)	- 0.6%	0.379
	Female	90 (4.2%)	33 (3.5%)	- 0.7%	0.337
Social Class	AB	35 (4.6%)	18 (5.2%)	+ 0.6%	0.694
	C1	46 (4.3%)	14 (2.6%)	- 1.7%	0.093*
	C2	32 (3.8%)	16 (4.3%)	+ 0.5%	0.706
	DE	45 (3.1%)	9 (1.6%)	- 1.5%	0.072*
Ethnicity	White	147 (4.0%)	53 (3.3%)	- 0.7%	0.221
	Ethnic Minority	10 (2.2%)	3 (1.5%)	- 0.7%	0.547
Household Income	< £16,000	37 (4.2%)	-	-	-
	£16,000 - £24,999	18 (3.4%)	-	-	-
	£25,000 - £34,999	14 (3.5%)	-	-	-
	£35,000 - £49,999	19 (5.4%)	-	-	-
	>£49,999	18 (5.2%)	-	-	-
Area Type	Urban	114 (3.6%)	35 (2.5%)	- 1.1%	0.072*
	Rural	44 (4.8%)	22 (5.2%)	+ 0.4%	0.777
Region	North East England	2 (1.1%)	-	-	-
	North West England	25 (5.2%)	-	-	-
	Yorkshire and the Humber	11 (3.1%)	-	-	-
	East Midlands	16 (5.5%)	-	-	-
	West Midlands	23 (6.3%)	-	-	-
	East of England	15 (4.3%)	-	-	-
	London	4 (0.8%)	-	-	-
	South East England	15 (2.6%)	-	-	-
	South West England	13 (3.8%)	-	-	-
	Wales	6 (3.0%)	-	-	-
	Scotland	24 (6.6%)	-	-	-
	Northern Ireland	4 (3.5%)	-	-	-
Total		**158 (3.8%)**	**57 (3.1%)**	**- 0.7%**	**0.196**

Sig. = Significance; Diff. = Difference; * = 90 per cent significance.

Data Adapted from BEIS (2019b) and BEIS (2020b)

Q183 – Which of these do you think are likely to occur in the UK in the next 15 to 20 years as a result of climate change?

Table Y.24 – Proportion of respondents that believe rising sea levels and/or more flooding will occur within the United Kingdom in the future due to climate change

Socio-Economic Factors		**March 2019**	**March 2020**	**Diff.**	**Sig.**
Age	16-24	241 (51.7%)	158 (62.2%)	+ 10.5%	0.007***
	25-34	344 (54.3%)	170 (58.8%)	+ 4.5%	0.204
	35-44	301 (53.8%)	140 (58.6%)	+ 4.8%	0.218
	45-54	296 (57.3%)	159 (65.2%)	+ 7.9%	0.038**
	55-64	357 (59.4%)	163 (61.5%)	+ 2.1%	0.559
	65+	668 (49.4%)	308 (59.1%)	+ 9.7%	0.000***
Gender	Male	1037 (52.4%)	534 (62.2%)	+ 9.8%	0.000***
	Female	1170 (54.4%)	564 (59.1%)	+ 4.7%	0.016**
Social Class	AB	492 (65.3%)	238 (68.6%)	+ 3.3%	0.277
	C1	651 (60.5%)	349 (64.7%)	+ 4.2%	0.097*
	C2	428 (51.4%)	215 (57.8%)	+ 6.4%	0.039**
	DE	636 (43.4%)	296 (53.4%)	+ 10.0%	0.000***
Ethnicity	White	1,983 (54.4%)	1,004 (63.0%)	+ 8.6%	0.000***
	Ethnic Minority	210 (47.0%)	87 (43.9%)	- 3.1%	0.475
Household Income	< £16,000	409 (47.0%)	-	-	-
	£16,000 - £24,999	299 (57.2%)	-	-	-
	£25,000 - £34,999	232 (57.9%)	-	-	-
	£35,000 - £49,999	218 (61.4%)	-	-	-
	>£49,999	221 (64.4%)	-	-	-
Area Type	Urban	1,709 (53.2%)	827 (59.7%)	+ 6.5%	0.000***
	Rural	498 (54.2%)	271 (63.5%)	+ 9.3%	0.001***
Region	North East England	102 (54.5%)	-	-	-
	North West England	276 (56.9%)	-	-	-
	Yorkshire and the Humber	195 (54.6%)	-	-	-
	East Midlands	123 (42.1%)	-	-	-
	West Midlands	190 (52.2%)	-	-	-
	East of England	161 (45.7%)	-	-	-
	London	236 (47.3%)	-	-	-
	South East England	340 (59.9%)	-	-	-
	South West England	202 (58.4%)	-	-	-
	Wales	112 (55.7%)	-	-	-
	Scotland	203 (55.9%)	-	-	-
	Northern Ireland	67 (58.3%)	-	-	-
Total		**2,207 (53.5%)**	**1,098 (60.6%)**	**+ 7.1%**	**0.000*** **

Sig. = Significance; Diff. = Difference; * = 90 per cent significance; ** = 95 per cent significance; * = 99 per cent significance.**

Data Adapted from BEIS (2019b) and BEIS (2020b)

Table Y.25 – Proportion of respondents that believe a reduction of food availability and/or impact on farming will occur within the United Kingdom in the future due to climate change

Socio-Economic Factors		**March 2019**	**March 2020**	**Diff.**	**Sig.**
Age	16-24	158 (33.9%)	101 (39.8%)	+ 5.9%	0.118
	25-34	229 (36.2%)	108 (37.4%)	+ 1.2%	0.727
	35-44	220 (39.4%)	76 (31.8%)	- 7.6%	0.043**
	45-54	180 (34.8%)	76 (31.1%)	- 3.7%	0.317
	55-64	207 (34.4%)	81 (30.6%)	- 3.8%	0.264
	65+	358 (26.5%)	138 (26.5%)	= 0.0%	0.990
Gender	Male	593 (29.9%)	270 (31.5%)	+ 1.6%	0.419
	Female	759 (35.3%)	310 (32.5%)	- 2.8%	0.127
Social Class	AB	302 (40.1%)	126 (36.3%)	- 3.8%	0.237
	C1	389 (36.2%)	182 (33.8%)	- 2.4%	0.344
	C2	261 (31.3%)	98 (26.3%)	- 5.0%	0.080*
	DE	400 (27.3%)	174 (31.4%)	+ 4.1%	0.067*
Ethnicity	White	1,194 (32.7%)	521 (32.7%)	= 0.0%	0.976
	Ethnic Minority	149 (33.3%)	56 (28.3%)	- 5.0%	0.204
Household Income	< £16,000	276 (31.7%)	-	-	-
	£16,000 - £24,999	187 (35.8%)	-	-	-
	£25,000 - £34,999	151 (37.7%)	-	-	-
	£35,000 - £49,999	146 (41.1%)	-	-	-
	>£49,999	135 (39.4%)	-	-	-
Area Type	Urban	1,063 (33.1%)	452 (32.6%)	- 0.5%	0.756
	Rural	289 (31.5%)	128 (30.0%)	- 1.5%	0.579
Region	North East England	49 (26.2%)	-	-	-
	North West England	172 (35.5%)	-	-	-
	Yorkshire and the Humber	99 (27.7%)	-	-	-
	East Midlands	69 (23.6%)	-	-	-
	West Midlands	144 (39.6%)	-	-	-
	East of England	105 (29.8%)	-	-	-
	London	152 (30.5%)	-	-	-
	South East England	217 (38.2%)	-	-	-
	South West England	112 (32.4%)	-	-	-
	Wales	59 (29.4%)	-	-	-
	Scotland	128 (35.3%)	-	-	-
	Northern Ireland	46 (40.0%)	-	-	-
Total		**1,352 (32.7%)**	**580 (32.0%)**	**- 0.7%**	**0.578**

Sig. = Significance; Diff. = Difference; * = 90 per cent significance; ** = 95 per cent significance.

Data Adapted from BEIS (2019b) and BEIS (2020b)

Table Y.26 – Proportion of respondents that believe a reduction of water availability and/or increased frequency/magnitude of droughts will occur within the United Kingdom in the future due to climate change

Socio-Economic Factors		March 2019	March 2020	Diff.	Sig.
Age	16-24	143 (30.7%)	93 (36.6%)	+ 5.9%	0.105
	25-34	213 (33.6%)	99 (34.3%)	+ 0.7%	0.857
	35-44	228 (40.8%)	79 (33.1%)	- 7.7%	0.040**
	45-54	197 (38.1%)	64 (26.2%)	- 11.9%	0.001***
	55-64	256 (42.6%)	83 (31.3%)	- 11.3%	0.002***
	65+	434 (32.1%)	122 (23.4%)	- 8.7%	0.000***
Gender	Male	675 (34.1%)	260 (30.3%)	- 3.8%	0.049**
	Female	796 (37.0%)	280 (29.4%)	- 7.6%	0.000***
Social Class	AB	345 (45.8%)	125 (36.0%)	- 9.8%	0.002***
	C1	438 (40.7%)	181 (33.6%)	- 7.1%	0.005***
	C2	284 (34.1%)	101 (27.2%)	- 6.9%	0.017**
	DE	404 (27.6%)	133 (24.0%)	- 3.6%	0.107
Ethnicity	White	1,324 (36.3%)	478 (30.0%)	- 6.3%	0.000***
	Ethnic Minority	137 (30.6%)	58 (29.3%)	- 1.3%	0.729
Household Income	< £16,000	284 (32.6%)	-	-	-
	£16,000 - £24,999	206 (39.4%)	-	-	-
	£25,000 - £34,999	155 (38.7%)	-	-	-
	£35,000 - £49,999	154 (43.4%)	-	-	-
	>£49,999	173 (50.4%)	-	-	-
Area Type	Urban	1,145 (35.7%)	423 (30.5%)	- 5.2%	0.001***
	Rural	326 (35.5%)	117 (27.4%)	- 8.1%	0.003***
Region	North East England	61 (32.6%)	-	-	-
	North West England	186 (38.4%)	-	-	-
	Yorkshire and the Humber	123 (34.5%)	-	-	-
	East Midlands	75 (25.7%)	-	-	-
	West Midlands	150 (41.2%)	-	-	-
	East of England	126 (35.8%)	-	-	-
	London	168 (33.7%)	-	-	-
	South East England	236 (41.5%)	-	-	-
	South West England	129 (37.3%)	-	-	-
	Wales	72 (35.8%)	-	-	-
	Scotland	105 (28.9%)	-	-	-
	Northern Ireland	40 (34.8%)	-	-	-
Total		**1,471 (35.6%)**	**540 (29.8%)**	**- 5.8%**	**0.000*** **

Sig. = Significance; Diff. = Difference; ** = 95 per cent significance; * = 99 per cent significance.**

Data Adapted from BEIS (2019b) and BEIS (2020b)

Table Y.27 – Proportion of respondents that believe a change in plants or wildlife [including plants and animal extinctions] will occur within the United Kingdom in the future due to climate change

Socio-Economic Factors		March 2019	March 2020	Diff.	Sig.
Age	16-24	207 (44.4%)	114 (44.9%)	+ 0.5%	0.905
	25-34	253 (40.0%)	120 (41.5%)	+ 1.5%	0.656
	35-44	257 (46.0%)	95 (39.7%)	- 6.3%	0.105
	45-54	227 (43.9%)	91 (37.3%)	- 6.6%	0.084*
	55-64	276 (45.9%)	92 (34.7%)	- 11.2%	0.002***
	65+	459 (33.9%)	168 (32.2%)	- 1.7%	0.490
Gender	Male	732 (37.0%)	317 (36.9%)	- 0.1%	0.991
	Female	947 (44.1%)	363 (38.1%)	- 6.0%	0.002***
Social Class	AB	374 (49.6%)	161 (46.4%)	- 3.2%	0.323
	C1	510 (47.4%)	207 (38.4%)	- 9.0%	0.001***
	C2	333 (40.0%)	129 (34.7%)	- 5.3%	0.081*
	DE	462 (31.5%)	183 (33.0%)	+ 1.5%	0.514
Ethnicity	White	1,500 (41.1%)	614 (38.5%)	- 2.6%	0.078*
	Ethnic Minority	166 (37.1%)	62 (31.3%)	- 5.8%	0.154
Household Income	< £16,000	338 (38.8%)	-	-	-
	£16,000 - £24,999	227 (43.4%)	-	-	-
	£25,000 - £34,999	181 (45.1%)	-	-	-
	£35,000 - £49,999	171 (48.2%)	-	-	-
	>£49,999	179 (52.2%)	-	-	-
Area Type	Urban	1,327 (41.3%)	511 (36.9%)	- 4.4%	0.005***
	Rural	352 (38.3%)	169 (39.6%)	+ 1.3	0.665
Region	North East England	77 (41.2%)	-	-	-
	North West England	213 (43.9%)	-	-	-
	Yorkshire and the Humber	124 (34.7%)	-	-	-
	East Midlands	87 (29.8%)	-	-	-
	West Midlands	163 (44.8%)	-	-	-
	East of England	128 (36.4%)	-	-	-
	London	175 (35.1%)	-	-	-
	South East England	257 (45.2%)	-	-	-
	South West England	153 (44.2%)	-	-	-
	Wales	83 (41.3%)	-	-	-
	Scotland	163 (44.9%)	-	-	-
	Northern Ireland	56 (48.7%)	-	-	-
Total		**1,679 (40.7%)**	**680 (37.5%)**	**- 3.2%**	**0.023****

Sig. = Significance; Diff. = Difference; * = 90 per cent significance; ** = 95 per cent significance; * = 99 per cent significance.**

Data Adapted from BEIS (2019b) and BEIS (2020b)

Table Y.28 – Proportion of respondents that believe that more health problem [e.g. asthma] will occur within the United Kingdom in the future due to climate change

Socio-Economic Factors		March 2019	March 2020	Diff.	Sig.
Age	16-24	187 (40.1%)	123 (48.4%)	+ 8.3%	0.031**
	25-34	282 (44.5%)	134 (46.4%)	+ 1.9%	0.607
	35-44	264 (47.2%)	109 (45.6%)	- 1.6%	0.674
	45-54	230 (44.5%)	103 (42.2%)	- 2.3%	0.555
	55-64	267 (44.4%)	100 (37.7%)	- 6.7%	0.066*
	65+	459 (33.9%)	185 (35.5%)	+ 1.6%	0.518
Gender	Male	752 (38.0%)	356 (41.5%)	+ 3.5%	0.078*
	Female	937 (43.6%)	398 (41.7%)	- 1.9%	0.328
Social Class	AB	325 (43.1%)	161 (46.4%)	+ 3.3%	0.306
	C1	495 (46.0%)	229 (42.5%)	- 3.5%	0.180
	C2	341 (40.9%)	143 (38.4%)	- 2.5%	0.414
	DE	528 (36.0%)	221 (39.9%)	+ 3.9%	0.108
Ethnicity	White	1,484 (40.7%)	647 (40.6%)	- 0.1%	0.953
	Ethnic Minority	190 (42.5%)	100 (50.5%)	+ 8.0%	0.060*
Household Income	< £16,000	364 (41.8%)	-	-	-
	£16,000 - £24,999	235 (44.9%)	-	-	-
	£25,000 - £34,999	185 (46.1%)	-	-	-
	£35,000 - £49,999	158 (44.5%)	-	-	-
	>£49,999	166 (48.4%)	-	-	-
Area Type	Urban	1,343 (41.8%)	604 (43.6%)	+ 1.8%	0.261
	Rural	346 (37.7%)	150 (35.1%)	- 2.6%	0.365
Region	North East England	61 (32.6%)	-	-	-
	North West England	213 (43.9%)	-	-	-
	Yorkshire and the Humber	111 (31.1%)	-	-	-
	East Midlands	111 (38.0%)	-	-	-
	West Midlands	163 (44.8%)	-	-	-
	East of England	146 (41.5%)	-	-	-
	London	212 (42.5%)	-	-	-
	South East England	248 (43.7%)	-	-	-
	South West England	129 (37.3%)	-	-	-
	Wales	72 (35.8%)	-	-	-
	Scotland	159 (43.8%)	-	-	-
	Northern Ireland	64 (55.7%)	-	-	-
Total		**1,689 (40.9%)**	**754 (41.6%)**	**+ 0.7%**	**0.611**

Sig. = Significance; Diff. = Difference; * = 90 per cent significance; ** = 95 per cent significance.

Data Adapted from BEIS (2019b) and BEIS (2020b)

Table Y.29 – Proportion of respondents that believe rising temperatures and/or hotter summers will occur within the United Kingdom in the future due to climate change

Socio-Economic Factors		**March 2019**	**March 2020**	**Diff.**	**Sig.**
Age	16-24	305 (65.5%)	158 (62.2%)	- 3.3%	0.385
	25-34	384 (60.7%)	152 (52.6%)	- 8.1%	0.021**
	35-44	361 (64.6%)	124 (51.9%)	- 12.7%	0.001***
	45-54	317 (61.3%)	125 (51.2%)	- 10.1%	0.008***
	55-64	369 (61.4%)	127 (47.9%)	- 13.5%	0.000***
	65+	736 (54.4%)	230 (44.1%)	- 10.3%	0.000***
Gender	Male	1,184 (59.8%)	448 (52.2%)	- 7.6%	0.000***
	Female	1,288 (59.9%)	468 (49.1%)	- 10.8%	0.000***
Social Class	AB	525 (69.6%)	205 (59.1%)	- 10.5%	0.001***
	C1	698 (64.9%)	297 (55.1%)	- 9.8%	0.000***
	C2	471 (56.5%)	180 (48.4%)	- 8.1%	0.009***
	DE	778 (53.1%)	234 (42.2%)	- 10.9%	0.000***
Ethnicity	White	2,182 (59.8%)	814 (51.1%)	- 8.7%	0.000***
	Ethnic Minority	268 (60.0%)	96 (48.5%)	- 11.5%	0.007***
Household Income	< £16,000	496 (56.9%)	-	-	-
	£16,000 - £24,999	321 (61.4%)	-	-	-
	£25,000 - £34,999	267 (66.6%)	-	-	-
	£35,000 - £49,999	236 (66.5%)	-	-	-
	>£49,999	247 (72.0%)	-	-	-
Area Type	Urban	1,927 (60.0%)	703 (50.8%)	- 9.2%	0.000***
	Rural	545 (59.4%)	213 (49.9%)	- 9.5%	0.001***
Region	North East England	112 (59.9%)	-	-	-
	North West England	279 (57.5%)	-	-	-
	Yorkshire and the Humber	209 (58.5%)	-	-	-
	East Midlands	168 (57.5%)	-	-	-
	West Midlands	215 (59.1%)	-	-	-
	East of England	233 (66.2%)	-	-	-
	London	310 (62.1%)	-	-	-
	South East England	379 (66.7%)	-	-	-
	South West England	214 (61.8%)	-	-	-
	Wales	102 (50.7%)	-	-	-
	Scotland	180 (49.6%)	-	-	-
	Northern Ireland	71 (61.7%)	-	-	-
Total		**2,472 (59.9%)**	**916 (50.6%)**	**- 9.3%**	**0.000*** **

Sig. = Significance; Diff. = Difference; ** = 95 per cent significance; * = 99 per cent significance.**

Data Adapted from BEIS (2019b) and BEIS (2020b)

Table Y.30 – Proportion of respondents that believe more extreme events [including storms] will occur within the United Kingdom in the future due to climate change

Socio-Economic Factors		March 2019	March 2020	Diff.	Sig.
Age	16-24	215 (46.1%)	149 (58.7%)	+ 12.6%	0.001***
	25-34	317 (50.1%)	146 (50.5%)	+ 0.4%	0.901
	35-44	298 (53.3%)	129 (54.0%)	+ 0.6%	0.863
	45-54	302 (58.4%)	129 (52.9%)	- 5.5%	0.150
	55-64	348 (57.9%)	145 (54.7%)	- 3.2%	0.383
	65+	636 (47.0%)	280 (53.7%)	+ 6.7%	0.009***
Gender	Male	1,011 (51.1%)	486 (56.6%)	+ 5.5%	0.006***
	Female	1,105 (51.4%)	492 (51.6%)	+ 0.2%	0.937
Social Class	AB	477 (63.3%)	220 (63.4%)	+ 0.1%	0.965
	C1	598 (55.6%)	302 (56.0%)	+ 0.4%	0.863
	C2	411 (49.3%)	185 (49.7%)	+ 0.4%	0.900
	DE	630 (43.0%)	271 (48.9%)	+ 5.9%	0.017**
Ethnicity	White	1,908 (52.3%)	890 (55.9%)	+ 3.6%	0.018**
	Ethnic Minority	193 (43.2%)	81 (40.9%)	- 2.3%	0.591
Household Income	< £16,000	421 (48.3%)	-	-	-
	£16,000 - £24,999	276 (52.8%)	-	-	-
	£25,000 - £34,999	222 (55.4%)	-	-	-
	£35,000 - £49,999	220 (62.0%)	-	-	-
	>£49,999	228 (66.5%)	-	-	-
Area Type	Urban	1,630 (50.8%)	745 (53.8%)	+ 3.0%	0.059*
	Rural	486 (52.9%)	233 (54.6%)	+ 1.7%	0.578
Region	North East England	93 (49.7%)	-	-	-
	North West England	244 (50.3%)	-	-	-
	Yorkshire and the Humber	153 (42.9%)	-	-	-
	East Midlands	130 (44.5%)	-	-	-
	West Midlands	192 (52.7%)	-	-	-
	East of England	160 (45.5%)	-	-	-
	London	212 (42.5%)	-	-	-
	South East England	340 (59.9%)	-	-	-
	South West England	196 (56.6%)	-	-	-
	Wales	113 (56.2%)	-	-	-
	Scotland	192 (52.9%)	-	-	-
	Northern Ireland	91 (79.1%)	-	-	-
Total		**2,116 (51.2%)**	**978 (54.0%)**	**+ 2.8%**	**0.053***

Sig. = Significance; Diff. = Difference; * = 90 per cent significance; ** = 95 per cent significance; * = 99 per cent significance.**

Data Adapted from BEIS (2019b) and BEIS (2020b)

Table Y.31 – Proportion of respondents that believe increased pollution will occur within the United Kingdom in the future due to climate change

Socio-Economic Factors		March 2019	March 2020	Diff.	Sig.
Age	16-24	247 (53.0%)	153 (60.2%)	+ 7.2%	0.062*
	25-34	331 (52.3%)	165 (57.1%)	+ 4.8%	0.175
	35-44	292 (52.2%)	115 (48.1%)	- 4.1%	0.286
	45-54	246 (47.6%)	115 (47.1%)	- 0.5%	0.907
	55-64	304 (50.6%)	109 (41.1%)	- 9.5%	0.010***
	65+	521 (38.5%)	190 (36.5%)	- 2.0%	0.415
Gender	Male	908 (45.9%)	399 (46.5%)	+ 0.6%	0.752
	Female	1,033 (48.1%)	448 (47.0%)	- 1.1%	0.568
Social Class	AB	390 (51.7%)	170 (49.0%)	- 2.7%	0.399
	C1	574 (53.3%)	280 (51.9%)	- 1.4%	0.596
	C2	383 (46.0%)	161 (43.3%)	- 2.7%	0.384
	DE	594 (40.5%)	236 (42.6%)	+ 2.1%	0.396
Ethnicity	White	1,701 (46.7%)	733 (46.0%)	- 0.7%	0.669
	Ethnic Minority	228 (51.0%)	109 (55.1%)	+ 4.1%	0.343
Household Income	< £16,000	388 (44.5%)	-	-	-
	£16,000 - £24,999	260 (49.7%)	-	-	-
	£25,000 - £34,999	222 (55.4%)	-	-	-
	£35,000 - £49,999	188 (53.0%)	-	-	-
	>£49,999	199 (58.0%)	-	-	-
Area Type	Urban	1,525 (47.5%)	662 (47.8%)	+ 0.3%	0.849
	Rural	416 (45.3%)	185 (43.3%)	- 2.0%	0.494
Region	North East England	76 (40.6%)	-	-	-
	North West England	237 (48.9%)	-	-	-
	Yorkshire and the Humber	126 (35.3%)	-	-	-
	East Midlands	150 (51.4%)	-	-	-
	West Midlands	175 (48.1%)	-	-	-
	East of England	165 (46.9%)	-	-	-
	London	248 (49.7%)	-	-	-
	South East England	292 (51.4%)	-	-	-
	South West England	156 (45.1%)	-	-	-
	Wales	99 (49.3%)	-	-	-
	Scotland	154 (42.4%)	-	-	-
	Northern Ireland	63 (54.8%)	-	-	-
Total		**1,941 (47.0%)**	**847 (46.7%)**	**- 0.3%**	**0.851**

Sig. = Significance; Diff. = Difference; * = 90 per cent significance; * = 99 per cent significance.**

Data Adapted from BEIS (2019b) and BEIS (2020b)

Table Y.32 – Proportion of respondents that believe increased frequency/magnitude of wildfires will occur within the United Kingdom in the future due to climate change

Socio-Economic Factors		March 2019	March 2020	Diff.	Sig.
Age	16-24	151 (32.4%)	81 (31.9%)	- 0.5%	0.888
	25-34	181 (28.6%)	80 (27.7%)	- 0.9%	0.775
	35-44	182 (32.6%)	59 (24.7%)	- 7.9%	0.027**
	45-54	168 (32.5%)	45 (18.4%)	- 14.1%	0.000***
	55-64	220 (36.6%)	62 (23.4%)	- 13.2%	0.000***
	65+	384 (28.4%)	117 (22.5%)	- 5.9%	0.009***
Gender	Male	585 (29.5%)	220 (25.6%)	- 3.9%	0.034**
	Female	701 (32.6%)	224 (23.5%)	- 9.1%	0.000***
Social Class	AB	295 (39.1%)	90 (25.9%)	- 13.2%	0.000***
	C1	376 (34.9%)	135 (25.0%)	- 9.9%	0.000***
	C2	244 (29.3%)	86 (23.1%)	- 6.2%	0.026**
	DE	371 (25.3%)	133 (24.0%)	- 1.3%	0.547
Ethnicity	White	1,169 (32.1%)	397 (24.9%)	- 7.2%	0.000***
	Ethnic Minority	108 (24.2%)	46 (23.2%)	- 1.0%	0.799
Household Income	< £16,000	255 (29.3%)	-	-	-
	£16,000 - £24,999	182 (34.8%)	-	-	-
	£25,000 - £34,999	141 (35.2%)	-	-	-
	£35,000 - £49,999	144 (40.6%)	-	-	-
	>£49,999	128 (37.3%)	-	-	-
Area Type	Urban	1,000 (31.1%)	345 (24.9%)	- 6.2%	0.000***
	Rural	286 (31.2%)	99 (23.2%)	- 8.0%	0.003***
Region	North East England	55 (29.4%)	-	-	-
	North West England	191 (39.4%)	-	-	-
	Yorkshire and the Humber	103 (28.9%)	-	-	-
	East Midlands	72 (24.7%)	-	-	-
	West Midlands	124 (34.1%)	-	-	-
	East of England	91 (25.9%)	-	-	-
	London	116 (23.2%)	-	-	-
	South East England	210 (37.0%)	-	-	-
	South West England	101 (29.2%)	-	-	-
	Wales	61 (30.3%)	-	-	-
	Scotland	120 (33.1%)	-	-	-
	Northern Ireland	42 (36.5%)	-	-	-
Total		**1,286 (31.1%)**	**444 (24.5%)**	**- 6.6%**	**0.000*** **

Sig. = Significance; Diff. = Difference; ** = 95 per cent significance; * = 99 per cent significance.**

Data Adapted from BEIS (2019b) and BEIS (2020b)

Table Y.33 – Proportion of respondents that believe increased frequency of coastal erosion will occur within the United Kingdom in the future due to climate change

Socio-Economic Factors		March 2019	March 2020	Diff.	Sig.
Age	16-24	165 (35.4%)	113 (44.5%)	+ 9.1%	0.017**
	25-34	250 (39.5%)	117 (40.5%)	+ 1.0%	0.776
	35-44	268 (47.9%)	94 (39.3%)	- 8.6%	0.025**
	45-54	255 (49.3%)	108 (44.3%)	- 5.0%	0.192
	55-64	304 (50.6%)	120 (45.3%)	- 5.3%	0.151
	65+	597 (44.1%)	240 (46.1%)	+ 2.0%	0.449
Gender	Male	848 (42.8%)	393 (45.8%)	+ 3.0%	0.142
	Female	991 (46.1%)	399 (41.8%)	- 4.3%	0.027**
Social Class	AB	431 (57.2%)	175 (50.4%)	- 6.8%	0.037**
	C1	538 (50.0%)	264 (49.0%)	- 1.0%	0.699
	C2	349 (41.9%)	151 (40.6%)	- 1.3%	0.671
	DE	521 (35.5%)	202 (36.5%)	+ 1.0%	0.699
Ethnicity	White	1,685 (46.2%)	741 (46.5%)	+ 0.3%	0.841
	Ethnic Minority	146 (32.7%)	48 (24.2%)	- 8.5%	0.032**
Household Income	< £16,000	344 (39.5%)	-	-	-
	£16,000 - £24,999	247 (47.2%)	-	-	-
	£25,000 - £34,999	200 (49.9%)	-	-	-
	£35,000 - £49,999	180 (50.7%)	-	-	-
	>£49,999	201 (58.6%)	-	-	-
Area Type	Urban	1,377 (42.9%)	607 (43.8%)	+ 0.9%	0.554
	Rural	462 (50.3%)	185 (43.3%)	- 7.0%	0.017**
Region	North East England	76 (40.6%)	-	-	-
	North West England	241 (49.7%)	-	-	-
	Yorkshire and the Humber	154 (43.1%)	-	-	-
	East Midlands	109 (37.3%)	-	-	-
	West Midlands	164 (45.1%)	-	-	-
	East of England	151 (42.9%)	-	-	-
	London	155 (31.1%)	-	-	-
	South East England	280 (49.3%)	-	-	-
	South West England	179 (51.7%)	-	-	-
	Wales	106 (52.7%)	-	-	-
	Scotland	160 (44.1%)	-	-	-
	Northern Ireland	64 (55.7%)	-	-	-
Total		**1,839 (44.5%)**	**792 (43.7%)**	**- 0.8%**	**0.553**

Sig. = Significance; Diff. = Difference; ** = 95 per cent significance.

Data Adapted from BEIS (2019b) and BEIS (2020b)

Table Y.34 – Proportion of respondents that believe changes to the seasons and/or erratic weather patterns will occur within the United Kingdom in the future due to climate change

Socio-Economic Factors		March 2019	March 2020	Diff.	Sig.
Age	16-24	4 (0.9%)	0 (0.0%)	- 0.9%	0.303
	25-34	0 (0.0%)	0 (0.0%)	= 0.0%	1.000
	35-44	4 (0.7%)	0 (0.0%)	- 0.7%	0.323
	45-54	5 (1.0%)	1 (0.4%)	- 0.6%	0.670
	55-64	0 (0.0%)	1 (0.4%)	+ 0.4%	0.306
	65+	6 (0.4%)	1 (0.2%)	- 0.2%	0.681
Gender	Male	9 (0.5%)	1 (0.1%)	- 0.4%	0.299
	Female	10 (0.5%)	2 (0.2%)	- 0.3%	0.364
Social Class	AB	6 (0.8%)	1 (0.3%)	- 0.5%	0.443
	C1	6 (0.6%)	1 (0.2%)	- 0.4%	0.436
	C2	2 (0.2%)	1 (0.2%)	+ 0.1%	1.000
	DE	5 (0.3%)	0 (0.0%)	- 0.3%	0.331
Ethnicity	White	18 (0.5%)	3 (0.2%)	- 0.3%	0.152
	Ethnic Minority	1 (0.2%)	0 (0.0%)	- 0.2%	1.000
Household Income	< £16,000	7 (0.8%)	-	-	-
	£16,000 - £24,999	3 (0.6%)	-	-	-
	£25,000 - £34,999	0 (0.0%)	-	-	-
	£35,000 - £49,999	0 (0.0%)	-	-	-
	>£49,999	3 (0.9%)	-	-	-
Area Type	Urban	13 (0.4%)	2 (0.1%)	- 0.3%	0.258
	Rural	6 (0.7%)	1 (0.2%)	- 0.5%	0.442
Region	North East England	0 (0.0%)	-	-	-
	North West England	1 (0.2%)	-	-	-
	Yorkshire and the Humber	3 (0.8%)	-	-	-
	East Midlands	0 (0.0%)	-	-	-
	West Midlands	0 (0.0%)	-	-	-
	East of England	1 (0.3%)	-	-	-
	London	0 (0.0%)	-	-	-
	South East England	3 (0.5%)	-	-	-
	South West England	4 (1.2%)	-	-	-
	Wales	3 (1.5%)	-	-	-
	Scotland	3 (0.8%)	-	-	-
	Northern Ireland	1 (0.9%)	-	-	-
Total		**19 (0.5%)**	**3 (0.2%)**	**- 0.3%**	**0.105**

Sig. = Significance; Diff. = Difference.

Data Adapted from BEIS (2019b) and BEIS (2020b)

Appendix Z – Example of the Eurobarometer Questionnaire [2019]

QB1 Which of the following statements best describes your opinion?

1. Climate change is entirely due to human activity
2. Climate change is partly due to human activity
3. Climate change is not at all due to human activity
4. There is no climate change/ I don’t believe in climate change
5. *Don’t Know*

QB2 Do you think that the following extreme weather events are due to climate change?

<table>
<tr><th colspan="2">Questions</th><th>Yes, definitely</th><th>Yes, to some extent</th><th>No, not really</th><th>No, not at all</th><th>Don’ t Know</th></tr>
<tr><td>1</td><td>Heat or cold waves</td><td rowspan="6">1</td><td rowspan="6">2</td><td rowspan="6">3</td><td rowspan="6">4</td><td rowspan="6">5</td></tr>
<tr><td>2</td><td>Droughts and wildfires</td></tr>
<tr><td>3</td><td>Floods</td></tr>
<tr><td>4</td><td>Hurricanes and heavy rainstorms</td></tr>
<tr><td>5</td><td>Earthquakes</td></tr>
<tr><td>6</td><td>Landslides</td></tr>
</table>

QB3a By 2050, which of the following is the most likely to intensify because of climate change? Firstly?

1. Increasing food and water shortages
2. Biodiversity loss
3. An increase in infectious diseases or epidemics
4. Soil degradation and desertification
5. A rise in mass migration to Europe
6. Damages to buildings and infrastructures
7. *Other (Question 4)*
8. *Don’t Know (Question 4)*

QB3b And then?

1. Increasing food and water shortages
2. Biodiversity loss
3. An increase in infectious diseases or epidemics
4. Soil degradation and desertification
5. A rise in mass migration to Europe
6. Damages to buildings and infrastructures
7. *Other*
8. *Don't Know*

QB4 To what extend do you agree or disagree with each of the following statements?

	Questions	Total Agree	Tend to Agree	Tend to Disagree	Totally Disagree	Don' t Know
1	More measures to promote and encourage recycling should be implemented in EU Member States	1	2	3	4	5
2	More measures to promote and encourage energy efficiency should be implemented in EU Member States					
3	More measures to promote and encourage the development of a clean and modern economy should be implemented in EU Member States					

QB5 To what extent do you agree or disagree with each of the following statements?

	Questions	Total Agree	Tend to Agree	Tend to Disagree	Totally Disagree	Don' t Know
1	Fighting Climate Change and using energy more efficiently can boost the economy and jobs in the EU?	1	2	3	4	5
2	Promoting EU expertise in new clean technologies to countries outside the EU can benefit the EU economically?					
3	Reducing fossil fuel imports from outside the EU can benefit the EU economically?					
4	Reducing fossil fuel imports from outside the EU can increase the security of EU energy supplies?					
5	More public financial support should be given to the transition to clean energies even if it means subsidies to fossil fuels should be reduced					

Appendix AA - Yonmenkaigi System Method Brief (11th October 2018)
Brief:

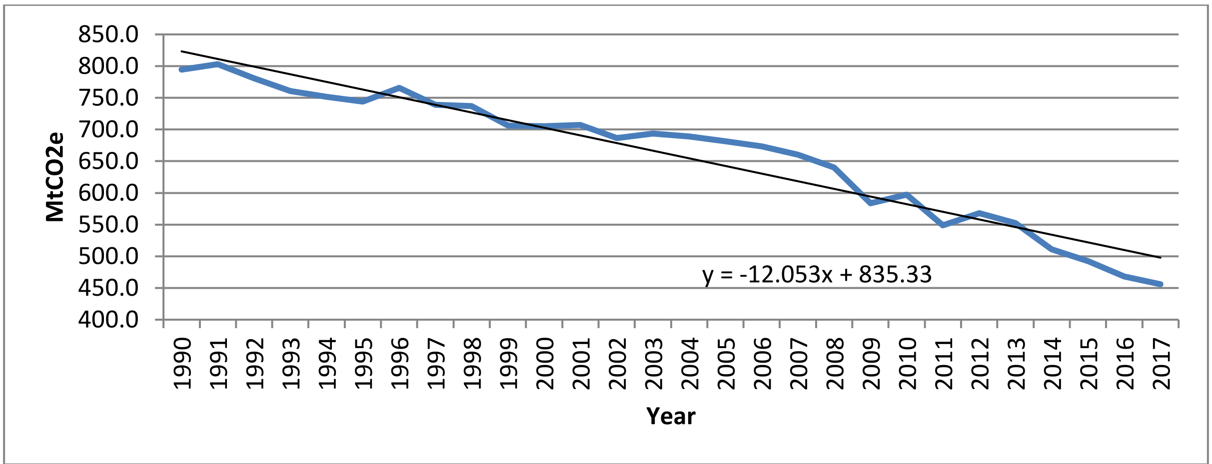
You being asked by Newcastle City Council to discuss and give ideas to how Newcastle can do to reduce the effects of climate change through mitigating and adaption.

Background to Climate Change:

Climate change is defined as the large variation in the state of climate, which can occur over an extended time period of a couple of decades or longer. Climate change can occur in both anthropogenic and natural forms. There is a consensus within the scientific community that current climate change is mainly caused by human causes. Within the last report by the Intergovernmental Panel on Climate Change (IPCC) in 2013, they warned that the planet faces "severe, pervasive and irreversible" effects due to climate change if greenhouse gas emissions are not drastically cut (IPCC, 2014a, p. 56). In 2018, the IPCC highlighted that the world has already experienced 1°C temperature increase since pre-industrial times. The official target by the United Nations is to limit temperature increase to 1.5°C. However, if greenhouse gas emissions continue at its current rate, it is expected that global temperatures will increase by 1.5°C target by 2030 and 2052.

As result of these increase global temperatures, it is expected that other elements of the climate will experience change. These include sea-level raise; species extinction; change in participations rates and patterns. In addition, it is expected that climate change will have an impact human health; food security; water supply; and economic growth.

United Kingdom Greenhouse Gas Emissions:



Climate Change in Newcastle-upon-Tyne:

Table 1 – Change within the North East of England between 1961 and 2006 (DEFRA UK Climate Change Projection, 2009)

	Spring	Summer	Autumn	Winter	Annual
Mean Temperature	1.43	1.57	1.13	1.86	1.46
Maximum Temperature	1.63	1.72	1.1	1.92	1.55
Minimum Temperature	1.19	1.42	1.13	1.78	1.35
Days of air frost	-5.3	-0.2	-5.0	-15.2	-28.2
Days of rain	-1.9	-1.8	2.4	2.7	0.1
Precipitation (mm)	4.6	-6.9	12.4	29.6	8.7

Table 2 – Projected Change of Weather within Newcastle-upon-Tyne by 2020s, 2050s and 2080s (DEFRA UK Climate Change Projection, 2009)

		Absolute Change		
	1961-1990	**2020s**	**2050s**	**2080s**
Summer Mean Temperature	13.5°C	14.1 – 16°C	14.6 – 18.2°C	14.8 – 20.7°C
Summer Mean Daily Maximum	17°C	17.4 – 20.2°C	17.9 – 22.9°C	17.9 – 24.9°C
Summer Mean Daily Minimum	10°C	10.5 – 12.4°C	10.9 – 14.6°C	11 – 17.3°C
Winter Mean Temperature	3°C	3.3 – 5°C	3.8 – 6.3°C	3.8 – 6.3°C
Summer Mean Precipitation	2mm/day	1.6 – 2.19 mm/day	1.36 – 2.15 mm/day	1.10 – 2.07 mm/day
Winter Mean Precipitation	2mm/day	1.91 – 2.37 mm/day	1.99 – 2.74 mm/day	2.05 – 3.20 mm/day

Appendix AB – Yonmenkaigi System Method Questionnaire

PLEASE NOTE, THERE ARE NO WRONG ANSWERS WITHIN THIS QUESTIONNAIRE!

Questionnaire 1

1. How worried are you about the following issues?

	Not at all Worried	Not Very Worried	Somewhat Worried	Very Worried	Extremely Worried
Air Pollution					
Climate Change					
Deforestation					
Diseases					
Economic Instability					
Espionage					
Genetic Engineering					
Migration					
Nuclear Weapons					
Terrorism					

2. Do you think that climate change is caused by natural processes, human activity, or both? (Please Circle)
   a. Entirely by Natural Processes
   b. Mainly by Natural Processes
   c. About Equally by Natural Processes and Human Activity
   d. Mainly by Human Activity
   e. Entirely by Human Activity

3. To what extend do you feel a personal responsibility to try to reduce climate change?

Not at all									A Great Deal
1	2	3	4	5	6	7	8	9	10

4. How good or bad do you think the impact of climate change will be on people across the world?

Bad									Good
1	2	3	4	5	6	7	8	9	10

5. How good or bad do you think the impact of climate change will be on people within the United Kingdom?

Bad									Good
1	2	3	4	5	6	7	8	9	10

6. Please indicate how much you agree or disagree with each of the following statements.

	Agree Strongly	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree
We can all do our bit to reduce the effects of climate change					
Climate change will improve the British weather					
The government should provide incentives for people to look after the environment					
It is already too late to do anything about climate change					
Developed countries should take most of the blame for climate change					
Radical change to society are needed to tackle climate change					
People are too selfish to do anything about climate change					
If I come across information about climate change, I tend to look at it					
Leaving the light on in my home and/or adds to climate change					
The impacts of climate change is already been felt within the UK					
Nothing I do on a regular basis contributes to climate change					
The Government is doing enough to combat climate change					

7. To what extent are you in favour or against the following policies in the United Kingdom to reduce climate change?

	Strongly in Favour	Somewhat in Favour	Neither in Favour nor Against	Somewhat Against	Strongly Against
Increasing taxes on petrol and diesel and petrol					
Increase Road Tax for non-electric car					
More Public Investment in Renewable Energy					
Increasing the government greenhouse gas emissions reduction targets					
Should ban the sale of pure petrol and diesel cars					

8. In your opinion, who within the UK is responsible for tackling climate change? *(Multiple Answers Allowed)*
    a. National Government
    b. Local Authorities
    c. Business and Industry
    d. Environmental Groups
    e. Researchers
    f. Your Personally

9. Have you personally taken any action to fight climate change over the past six months?
    a. Yes
    b. No
    c. Don't Know

10. How likely are you to take personally action to fight climate change in the next six months?

Unlikely									Very Likely
1	2	3	4	5	6	7	8	9	10

Appendix AC – Google Trends Results

Table AC.1 – Google Trends Levels for Climate Change, Global Warming, Global Cooling and Climate Emergency within the United Kingdom between January 2004 and July 2020

Month	Climate Change	Global Warming	Global Cooling	Climate Emergency	CC vs GW
January 2004	12	43	0	0	-31
February 2004	20	35	1	0	-15
March 2004	16	38	0	0	-22
April 2004	10	21	0	0	-11
May 2004	17	32	0	0	-15
June 2004	10	35	1	0	-25
July 2004	10	20	0	0	-10
August 2004	9	8	0	0	1
September 2004	15	30	1	0	-15
October 2004	16	29	1	0	-13
November 2004	21	46	1	0	-25
December 2004	16	28	0	0	-12
January 2005	22	51	1	0	-29
February 2005	21	48	1	0	-27
March 2005	16	39	1	0	-23
April 2005	13	31	1	0	-18
May 2005	14	32	1	0	-18
June 2005	17	35	0	0	-18
July 2005	14	23	1	0	-9
August 2005	11	10	0	0	1
September 2005	14	29	0	0	-15
October 2005	19	30	0	0	-11
November 2005	25	43	1	0	-18
December 2005	18	26	0	0	-8
January 2006	19	40	0	0	-21
February 2006	26	39	1	0	-13
March 2006	33	48	0	0	-15
April 2006	16	23	0	0	-7
May 2006	19	34	1	0	-15
June 2006	23	45	0	0	-22
July 2006	16	25	0	0	-9
August 2006	14	7	0	0	7
September 2006	20	33	0	0	-13
October 2006	32	43	0	0	-11
November 2006	36	60	0	0	-24
December 2006	21	34	0	0	-13
January 2007	34	58	0	0	-24
February 2007	40	66	1	0	-26
March 2007	44	100	0	0	-56
April 2007	28	48	0	0	-20
May 2007	32	47	0	0	-15
June 2007	25	57	0	0	-32
July 2007	23	40	0	0	-17

Table AC.1 – Google Trends Levels for Climate Change, Global Warming, Global Cooling and Climate Emergency within the United Kingdom between January 2004 and July 2020 (Continued)

Month	Climate Change	Global Warming	Global Cooling	Climate Emergency	CC vs GW
August 2007	20	13	0	0	7
September 2007	22	31	0	0	-9
October 2007	29	39	0	0	-10
November 2007	33	45	0	0	-12
December 2007	28	36	0	0	-8
January 2008	26	45	0	0	-19
February 2008	29	44	0	0	-15
March 2008	27	40	0	0	-13
April 2008	26	35	1	0	-9
May 2008	21	30	0	0	-9
June 2008	25	40	0	0	-15
July 2008	15	23	1	0	-8
August 2008	13	8	0	0	5
September 2008	20	24	0	0	-4
October 2008	26	28	0	0	-2
November 2008	26	34	0	0	-8
December 2008	24	24	0	0	0
January 2009	25	32	1	0	-7
February 2009	24	34	0	0	-10
March 2009	30	38	0	0	-8
April 2009	24	27	0	0	-3
May 2009	21	27	0	0	-6
June 2009	24	30	0	0	-6
July 2009	21	17	1	0	4
August 2009	16	6	0	0	10
September 2009	22	21	0	0	1
October 2009	31	29	0	0	2
November 2009	40	39	0	0	1
December 2009	48	37	1	0	11
January 2010	29	38	1	0	-9
February 2010	31	33	0	0	-2
March 2010	28	34	0	0	-6
April 2010	22	21	0	0	1
May 2010	22	24	0	0	-2
June 2010	17	20	0	0	-3
July 2010	13	12	0	0	1
August 2010	11	5	0	0	6
September 2010	15	15	0	0	0
October 2010	19	18	0	0	1
November 2010	23	26	0	0	-3
December 2010	17	18	0	0	-1
January 2011	20	27	0	0	-7
February 2011	22	27	0	0	-5
March 2011	25	33	0	0	-8
April 2011	15	17	0	0	-2

Table AC.1 – Google Trends Levels for Climate Change, Global Warming, Global Cooling and Climate Emergency within the United Kingdom between January 2004 and July 2020 (Continued)

Month	Climate Change	Global Warming	Global Cooling	Climate Emergency	CC vs GW
May 2011	18	23	0	0	-5
June 2011	16	20	0	0	-4
July 2011	12	12	0	0	0
August 2011	8	5	0	0	3
September 2011	12	16	0	0	-4
October 2011	18	18	0	0	0
November 2011	22	23	0	0	-1
December 2011	16	16	0	0	0
January 2012	17	24	0	0	-7
February 2012	17	25	0	0	-8
March 2012	19	26	0	0	-7
April 2012	15	14	0	0	1
May 2012	16	18	0	0	-2
June 2012	11	12	0	0	-1
July 2012	9	8	0	0	1
August 2012	8	5	0	0	3
September 2012	12	12	0	0	0
October 2012	15	16	0	0	-1
November 2012	17	19	0	0	-2
December 2012	13	12	0	0	1
January 2013	15	17	0	0	-2
February 2013	15	17	0	0	-2
March 2013	17	17	0	0	0
April 2013	15	14	0	0	1
May 2013	15	15	0	0	0
June 2013	12	14	0	0	-2
July 2013	9	7	0	0	2
August 2013	6	3	0	0	3
September 2013	13	11	0	0	2
October 2013	15	13	0	0	2
November 2013	19	17	0	0	2
December 2013	12	11	0	0	1
January 2014	16	15	0	0	1
February 2014	19	16	0	0	3
March 2014	19	17	0	0	2
April 2014	15	10	0	0	5
May 2014	15	12	0	0	3
June 2014	12	11	0	0	1
July 2014	9	6	0	0	3
August 2014	7	4	0	0	3
September 2014	15	11	0	0	4
October 2014	14	11	0	0	3
November 2014	18	14	0	0	4
December 2014	13	10	0	0	3
January 2015	16	13	0	0	3

Table AC.1 – Google Trends Levels for Climate Change, Global Warming, Global Cooling and Climate Emergency within the United Kingdom between January 2004 and July 2020 (Continued)

Month	Climate Change	Global Warming	Global Cooling	Climate Emergency	CC vs GW
February 2015	17	14	0	0	3
March 2015	19	13	0	0	6
April 2015	15	10	0	0	5
May 2015	14	10	0	0	4
June 2015	15	10	0	0	5
July 2015	10	6	0	0	4
August 2015	8	3	0	0	5
September 2015	14	9	0	0	5
October 2015	15	10	0	0	5
November 2015	26	14	0	0	12
December 2015	25	14	0	0	11
January 2016	18	11	0	0	7
February 2016	17	9	0	0	8
March 2016	17	10	0	0	7
April 2016	16	9	0	0	7
May 2016	16	9	0	0	7
June 2016	11	7	0	0	4
July 2016	10	4	0	0	6
August 2016	8	3	0	0	5
September 2016	12	6	0	0	6
October 2016	15	7	0	0	8
November 2016	25	12	0	0	13
December 2016	16	8	0	0	8
January 2017	20	10	0	0	10
February 2017	18	10	0	0	8
March 2017	20	11	0	0	9
April 2017	14	7	0	0	7
May 2017	16	8	0	0	8
June 2017	19	9	0	0	10
July 2017	10	5	0	0	5
August 2017	9	3	0	0	6
September 2017	13	7	0	0	6
October 2017	15	7	0	0	8
November 2017	18	9	0	0	9
December 2017	13	7	0	0	6
January 2018	16	10	0	0	6
February 2018	15	8	0	0	7
March 2018	14	9	0	0	5
April 2018	14	6	0	0	8
May 2018	14	7	0	0	7
June 2018	10	6	0	0	4
July 2018	10	6	0	0	4
August 2018	9	4	0	0	5
September 2018	10	5	0	0	5
October 2018	22	9	0	0	13

Table AC.1 – Google Trends Levels for Climate Change, Global Warming, Global Cooling and Climate Emergency within the United Kingdom between January 2004 and July 2020 (Continued)

Month	Climate Change	Global Warming	Global Cooling	Climate Emergency	CC vs GW
November 2018	21	8	0	0	13
December 2018	18	7	0	0	11
January 2019	17	8	0	0	9
February 2019	29	13	0	1	16
March 2019	31	10	0	1	21
April 2019	48	11	0	1	37
May 2019	38	12	0	4	26
June 2019	31	10	0	2	21
July 2019	25	8	0	2	17
August 2019	21	6	0	1	15
September 2019	52	11	0	2	41
October 2019	39	9	0	2	30
November 2019	38	10	0	2	28
December 2019	30	9	0	1	21
January 2020	41	11	0	1	30
February 2020	35	9	0	2	26
March 2020	30	10	0	1	20
April 2020	22	7	0	1	15
May 2020	21	7	0	0	14
June 2020	22	8	0	1	14
July 2020	16	5	0	0	11

CC = Climate Change; GW = Global Warming; Blue Cells = More 'Climate Change' searches; Red Cells = More 'Global Warming' searches

Data Adapted from Google Trends (2020)

Appendix AD – Questionnaire 1 Results

Question 13 – How trustworthy do you think different people and organisations are in relation in terms of communicating the truth of climate change? *(Please tick only one response per row)*

Table AD.1 – The truthfulness in communicating climate change by different individuals and institutions according to respondents, 2017

	Trustful	Medium	Not Trustful	Don't Know/Refused
Celebrities	118 10.4%	390 34.4%	607 53.5%	19 1.7%
Education	676 59.6%	253 22.3%	196 17.3%	9 0.8%
Environmental Group	668 58.9%	179 15.8%	279 24.6%	8 0.7%
Family	230 20.3%	617 54.4%	271 23.9%	16 1.4%
Friend	229 20.2%	605 53.4%	281 24.8%	19 1.7%
Local Government	442 39.0%	348 30.7%	330 29.1%	14 1.2%
National Government	394 34.7%	265 23.4%	466 41.1%	9 0.8%
Police	173 15.3%	626 55.2%	315 27.8%	20 1.8%
Religious Leader	155 13.7%	421 37.1%	541 47.7%	17 1.5%
Scientists and Researchers	877 77.3%	110 9.7%	138 12.2%	9 0.8%

Question 24 – Are you a member of an environmental organisation?

Table AD.2 – Proportion of respondents that are a member of an environmental organisation, 2017

	Yes	No	Refused	Total
Overall	171 (15.1%)	954 (84.1%)	9 (0.8%)	1,134
18-24	19 (11.7%)	144 (88.3%)	0 (0.0%)	163
25-34	18 (11.9%)	133 (88.1%)	0 (0.0%)	151
35-44	15 (13.0%)	99 (86.1%)	1 (0.9%)	115
45-54	30 (17.9%)	137 (81.5%)	1 (0.6%)	168
55-64	41 (17.8%)	187 (81.3%)	2 (0.9%)	230
65+	46 (15.2%)	251 (83.1%)	5 (1.7%)	302
Male	113 (16.7%)	558 (82.4%)	6 (0.9%)	677
Female	58 (12.9%)	387 (86.4%)	3 (0.7%)	448

Question 23 – Which of the following have you undertaken in the last three years, which have reduced your contributions towards climate change?

Table AD.3 – Climate change mitigation engagement action by age group, 2017

	18-24	25-34	35-44	45-54	55-64	65+	Overall
Driving an electric/hybrid car	7 (4.3%)	9 (6.0%)	7 (6.1%)	6 (3.6%)	21 (9.1%)	24 (7.9%)	74 (6.5%)
Making fewer car journeys	62 (38.0%)	63 (41.7%)	46 (40.0%)	63 (37.5%)	93 (40.4%)	122 (40.4%)	450 (39.7%)
Car share to work	18 (11.0%)	23 (15.2%)	11 (9.6%)	19 (11.3%)	13 (5.7%)	17 (5.6%)	101 (8.9%)
Walk or cycle to work	95 (58.3%)	88 (58.3%)	53 (46.1%)	64 (38.1%)	69 (30.0%)	59 (19.5%)	430 (37.9%)
Usage of Public Transport (e.g. Bus and Trains)	107 (65.6%)	97 (64.2%)	52 (45.2%)	64 (38.1%)	89 (38.7%)	135 (44.7%)	547 (48.2%)
Buy second hand produces	41 (25.2%)	56 (37.1%)	36 (31.3%)	68 (40.5%)	68 (29.6%)	67 (22.2%)	337 (29.7%)
Buy food with less packaging	75 (46.0%)	96 (63.6%)	63 (54.8%)	103 (61.3%)	143 (62.2%)	171 (56.6%)	654 (57.7%)
Buy locally grown food	71 (43.6%)	80 (53.0%)	59 (51.3%)	84 (50.0%)	136 (59.1%)	165 (54.6%)	599 (52.8%)
Eat less meat	67 (41.1%)	72 (47.7%)	38 (33.0%)	56 (33.3%)	79 (34.3%)	100 (33.1%)	414 (36.5%)
Grow your own food	18 (11.0%)	36 (23.8%)	33 (28.7%)	42 (25.0%)	66 (28.7%)	102 (33.8%)	301 (26.5%)
Install house insulation	38 (23.3%)	29 (19.2%)	42 (36.5%)	78 (46.4%)	125 (54.3%)	183 (60.6%)	497 (43.8%)
Install low energy light bulbs	105 (64.4%)	104 (68.9%)	83 (72.2%)	140 (83.3%)	193 (83.9%)	259 (85.8%)	889 (78.4%)
Install renewable energy	12 (7.4%)	11 (7.3%)	19 (16.5%)	32 (19.0%)	49 (21.3%)	68 (22.5%)	191 (16.8%)
Unplug appliance when not used	108 (66.3%)	94 (62.3%)	47 (40.9%)	84 (50.0%)	118 (51.3%)	130 (43.0%)	585 (51.6%)
Switch off lights	152 (93.3%)	132 (87.4%)	87 (75.7%)	131 (78.0%)	184 (80.0%)	238 (78.8%)	929 (81.9%)
Turn down heating	118 (72.4%)	113 (74.8%)	73 (63.5%)	121 (72.0%)	151 (65.7%)	184 (60.9%)	763 (67.3%)
Use water sparingly	74 (45.4%)	71 (47.0%)	42 (36.5%)	77 (45.8%)	104 (45.2%)	155 (51.3%)	527 (46.5%)
Reduce personal waste production	69 (42.3%)	76 (50.3%)	54 (47.0%)	94 (56.0%)	138 (60.0%)	154 (51.0%)	588 (51.9%)
Recycle waste	147 (90.2%)	132 (87.4%)	96 (83.5%)	143 (85.1%)	206 (89.6%)	265 (87.7%)	994 (87.7%)

Appendix AE – Definition of Terms

"Diseases" refers to any infectious virus, bacteria or other pathogen that spreads throughout the human race. Diseases are a concern to the public, where they have a history of killing large numbers of people. An example is the H1N1 influenza flu, commonly known as Spanish flu, which occurred between 1918 and 1920. It is estimated that the Spanish flu killed 50 million people, roughly between 3 and 5 percent of the world's population (Taubenberger and Morens, 2006). Whilst such illnesses are rare, there have been a number of diseases in recent years that have caught the public's attention, for example COVID-19; Ebola and Zika viruses; and swine influenza.

"Economic Instability" refers to communities and nations experiencing financial struggles. This can be attributed to high unemployment, significantly higher costs of products and services. These can affect the survivability of businesses and the financial, mental and physical well-being of individuals. There are two major examples of "economic instability" within the United Kingdom, Great Depression, which occurred between 1929 and 1939; and the Great Recession, which occurred in the late 2000s and early 2010s. The second one is fresh of the mind of most people within the United Kingdom, especially the youth, as its employment rates were highest amongst this group (Bell and Blanchflower, 2011).

"Espionage" is colloquially known as spying, in which secret information is collected without the permission of the holder. Typically, high profile cases involve governmental espionage; however, the News of the World Phone Hacking in the 2000s, demonstrated that espionage occurs at all levels.

"Migration" is when people move from one country to another with the intension of settling into a new permanent home, though there can also be temporary short-term migrations. Migration usually occurs in varying forms, such as mobility for a better life, mainly financial; or through explicit force, such as fleeing wars and/or persecution or extreme poverty. Migration has been in the news a lot in recent years, with many fleeing the war in Syria and the persecution of the IS. This has become to be known as the European Migration Crisis. It is thought by many experts that this migration crisis was a partial cause of the United Kingdom leaving the European Union; and the rise of the far right-wing political parties across Europe; for example, Front National in France; and Alternative für Deutschland in Germany.

"Nuclear Weapons" are explosive devices that are caused by a nuclear reaction. In the history of Europe, there have only been two nuclear weapons used in war situations. These are on the Japanese populations of Hiroshima and Nagasaki in August 1945 by the United States to end World War Two. During the height of the Cold War in the 1960s, 1970s and 1980s, there was a high level of concern amongst the public about a nuclear holocaust between the United States and Soviet Union. This is demonstrated in the number of movies and songs around this period that were based upon this issue. Whilst the threat of a nuclear holocaust has significantly reduced since the collapse of the Soviet Union, the concern in recent years and risen due to rising tensions between NATO and Russia; North Korea and the United States; and dirty bombs from terrorist groups, such as IS, resulting in a growing number of articles in the media.

"Political tensions" includes acts of war against sovereign nations, for example the bombing of Yemen; major verbal disagreements/political standoffs between nations, such as bombing by France, the United Kingdom and the United States in April 2018 against Syria in the aftermath of the suspected chemical attacks in Douma. Another example of recent political tensions is in the aftermath of the use of Novichok in Salisbury, United Kingdom in March 2018, suspected to have been carried out by the Russian Government against a former Russian double agent and his daughter.

"Terrorism" refers to the use of intentional indiscriminate violence, both in terror or fear, to achieve a political, religious, or ideological aim (Fortna, 2015). The current terrorism, which is all over the front pages of newspapers, has its origins to the terrorist attacks throughout the East Coast of the United States on September 11th 2001; which created the War on Terror. Whilst terrorism within the United Kingdom is rare, the United Kingdom does have a long history with terrorism. For example, the Gunpowder Plot in 1605, that had the aim of blowing up the Houses of Parliament. The peak in terrorist attacks within the United Kingdom was between the late 1960s and 1998, with the bombing campaign by the Irish Republic Army (IRA), especially in Northern Ireland; but its most famous was the Brighton Bombing 1984, in attempt to assassinate the then British Prime Minister, Margaret Thatcher. However, in recent years, there has been an increase of terrorism in Europe; and especially in France and the United Kingdom. For example, the Manchester Arena terrorists attack on the 22nd May 2017[78].

[78] - The Manchester Arena Bombings occurred when people were leaving an Ariana Grande concert, killing 23 people and injuring 250.

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